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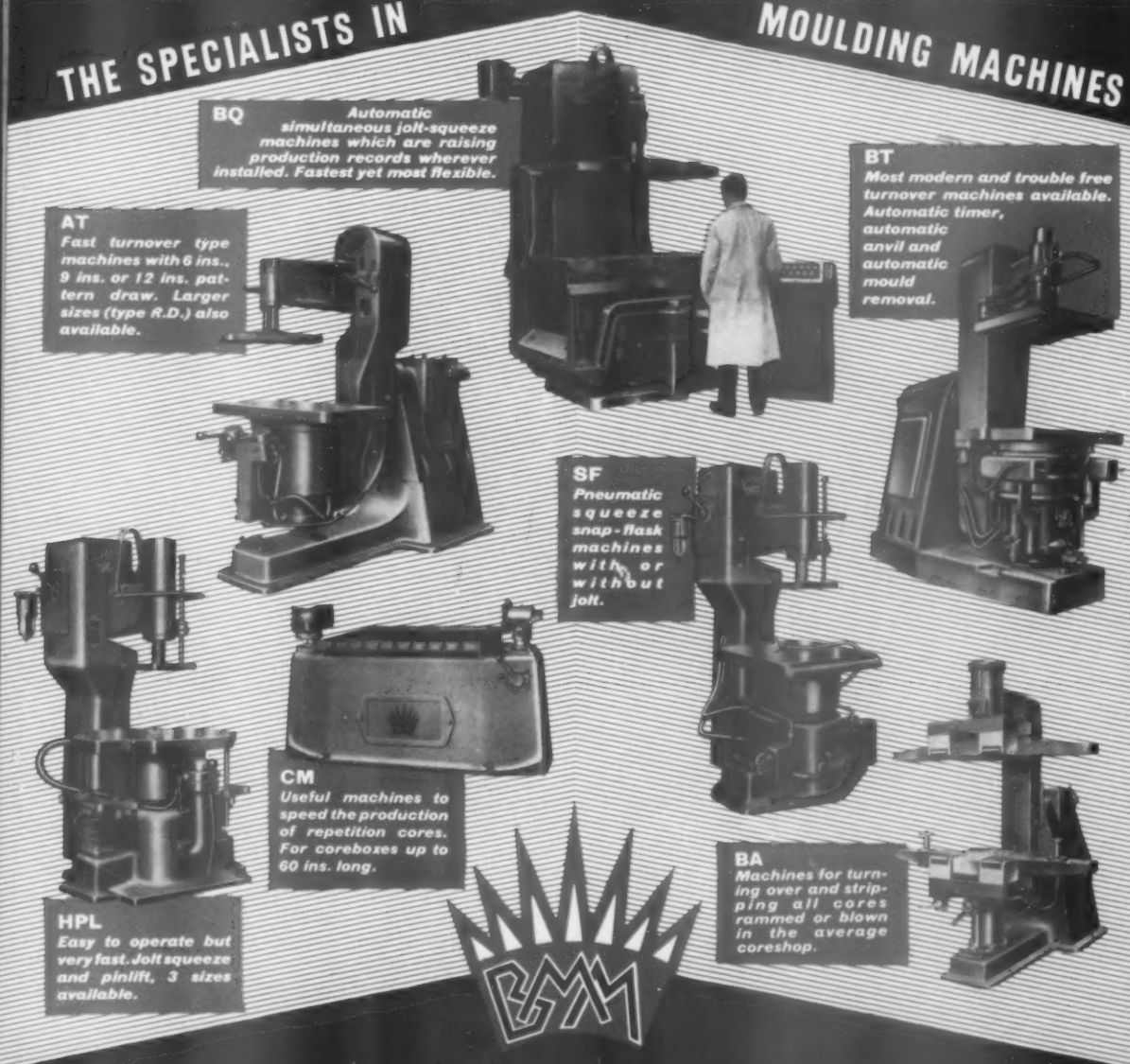
THE SPECIALISTS IN MOULDING MACHINES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Automatic simultaneous jolt-squeeze machines which are raising production records wherever installed. Fastest yet most flexible.
AT
Fast turnover type machines with 6 ins., 9 ins. or 12 ins. pattern draw. Larger sizes (type R.D.) also available.
BT
Most modern and trouble free turnover machines available. Automatic timer, automatic anvil and automatic mould removal.
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Pneumatic squeeze snap-flask machines with or without jolt.
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Useful machines to speed the production of repetition cores. For coreboxes up to 60 ins. long.
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Easy to operate but very fast. Jolt squeeze and pinlift, 3 sizes available.
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Machines for turning over and stripping all cores rammed or blown in the average coreshop.
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Bringing a new nodularising alloy (Alloy 55) to the S.G. ironfounder.

Marketing ferro alloy briquettes in a totally new way—
as the modern foundryman wants them.

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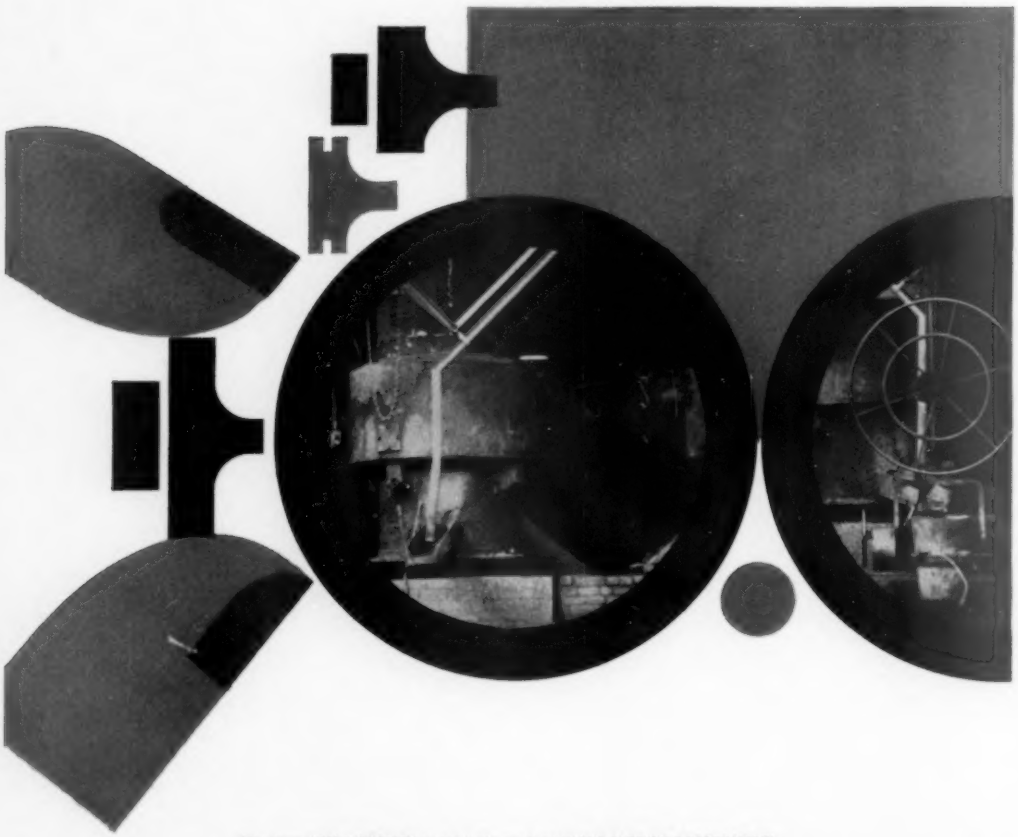

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CRC A61

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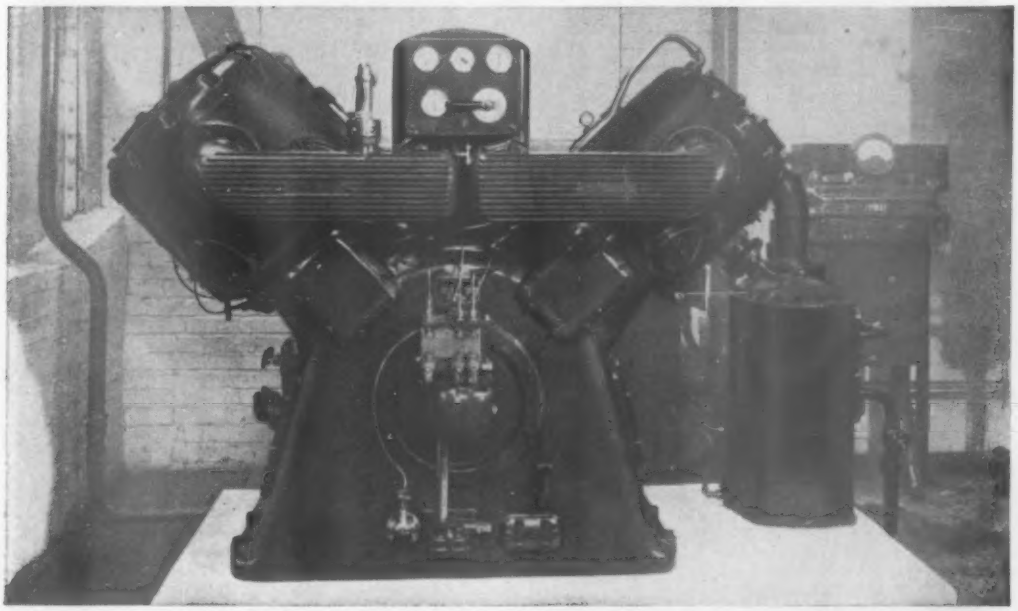

Photo by courtesy of Messrs. Broom & Wade, Ltd., High Wycombe, Bucks.

Spermolin core oils ensure the very finest quality castings. They helped produce the castings for this famous 'BROOMWADE' machine—a two-stage double acting air compressor of advanced design, Type V500, which delivers 525 cu. ft. of free air per minute at 100 lbs./□" pressure.
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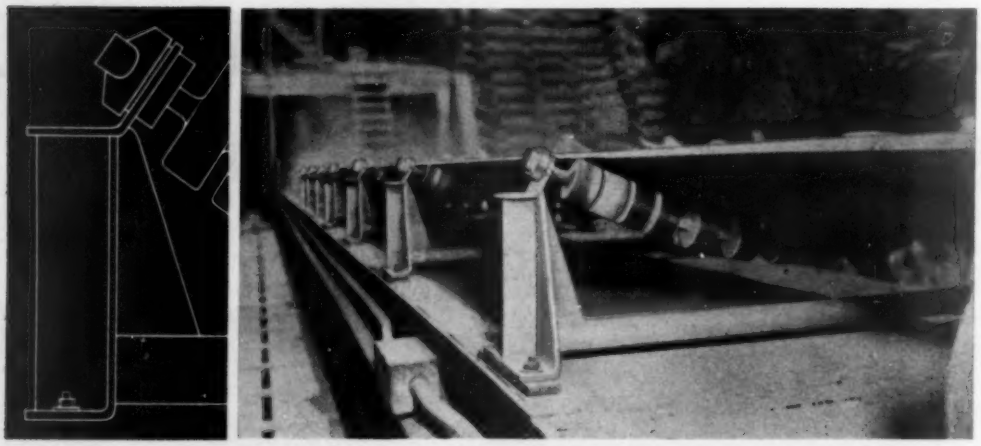
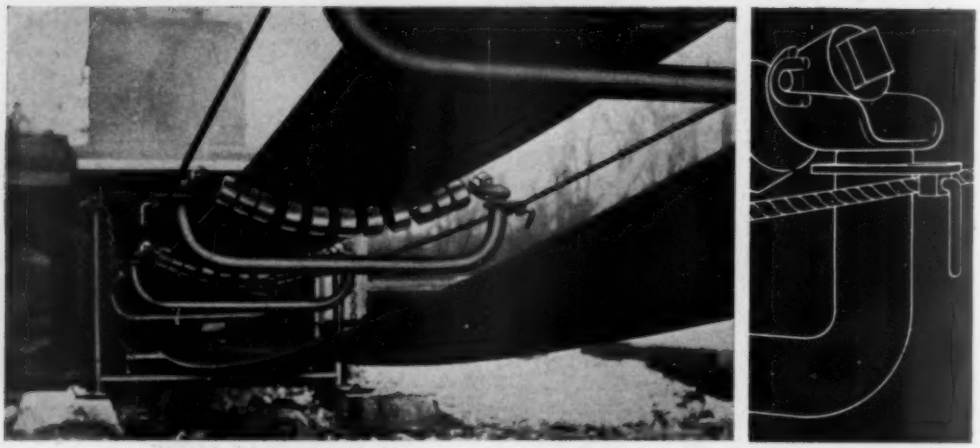


TWO SAVING WAYS WITH BELT CONVEYORS



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Joy Limberope conveyor structures offer all the savings of the Joy-Limberoller plus easier and faster set-up, dismantling and relocating. They give a well-trained belt, are low in first cost... maintenance cost, and are easily transported from site to site. Savings indeed for any thrifty belt conveyor user!

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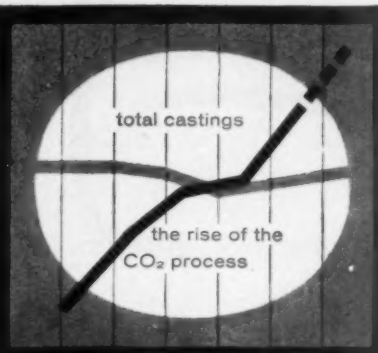

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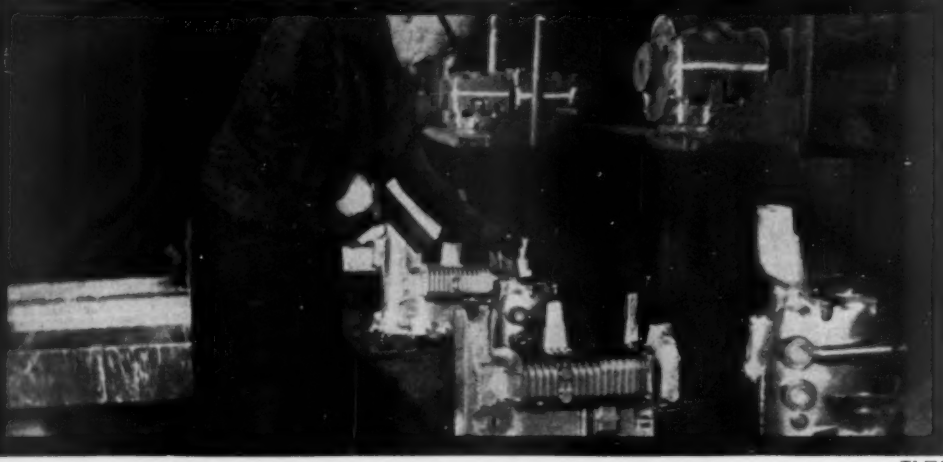
HARD AND FAST FACTS 4

the quality control of the CO_2 process for making better cores and moulds faster

DCL C2



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The Adaptable FLEXOBELT

It grinds ★ sands ★ polishes ★

The Flexobelt attachment, designed for use on Flextol GF350 3-speed machine, is a most useful and versatile attachment for use in your shops. It will grind castings, remove surplus metal from welds, repairs, etc., and will carry out much of the work for which a whole range of grinding wheels, disc sanders, roller sanders and polishers are normally used. It works equally well on concave or convex surfaces, or even on jobs of irregular shape, and its use prevents burning of the metal, and it is particularly good for working on stainless steel. Interchangeable belts are used to cover all operations from grinding to final polishing. May we send you full particulars?

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AP 27

DOHMfrac IN THE MOTOR INDUSTRY

Most modern cars have components cast with DOHMfrac resin coated sand.

The demand today is for thinner, stronger shells requiring a coated sand of uniform particle size and uniformly coated.

DOHMfrac is by far the most widely used resin coated sand, not in the Motor Industry only, but in modern repetition foundries generally.

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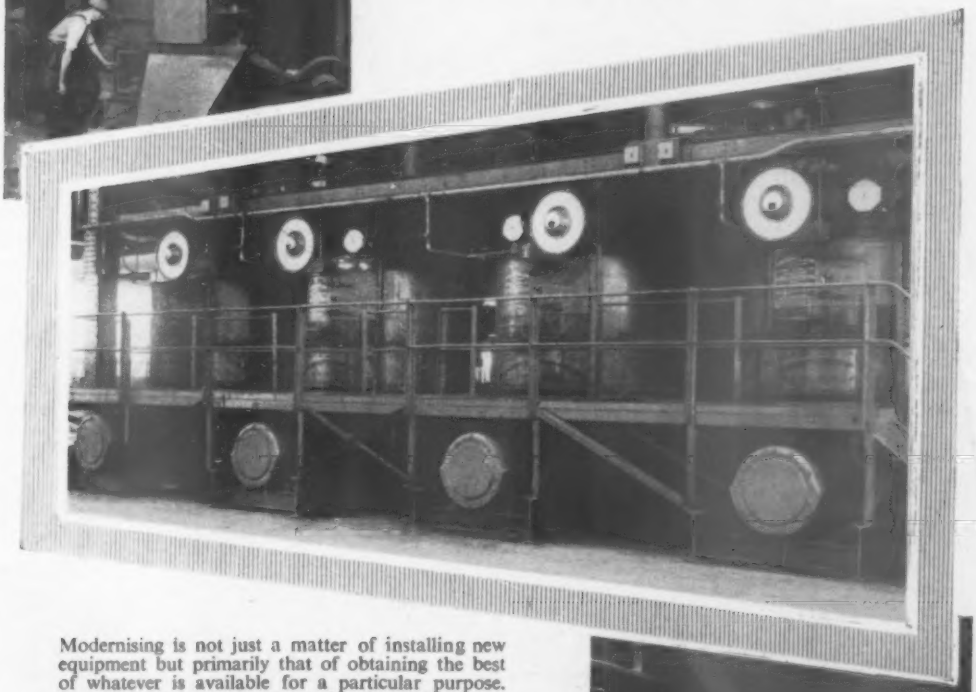
More and more modern foundries are specifying the

SPEEDMULLOR

to mull their mould or core sand



Modernising is not just a matter of installing new equipment but primarily that of obtaining the best of whatever is available for a particular purpose. That is why more and more modern foundries choose the Speedmullor for the preparation of their sand. One single foundry in this country operates 10 Speedmullors and one multiple company uses 14. More foundry sand is mulled in Speedmullors than by any other method because, only Speedmullor mulling can develop the full physical properties of moulding sand and core sand mixtures with minimum bond and at lowest cost per ton of sand mulled. Full development of physical properties with maximum Speedmullor uniformity and control provides higher quality castings with better surface finish and the elimination of casting defects.

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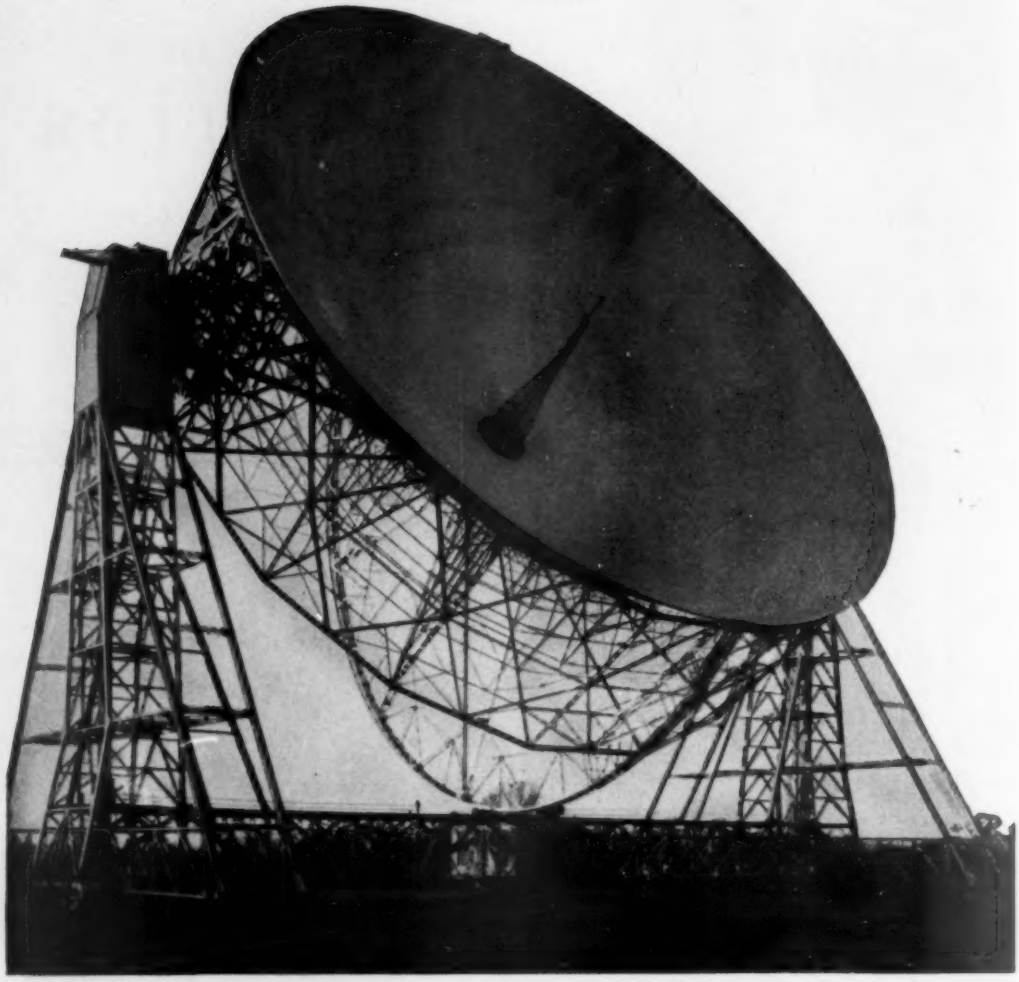

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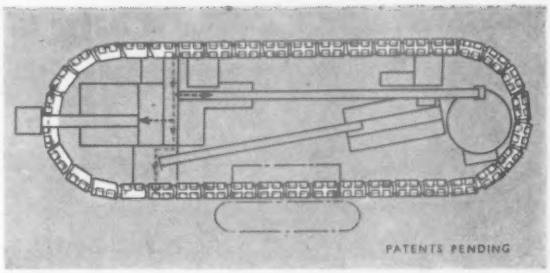
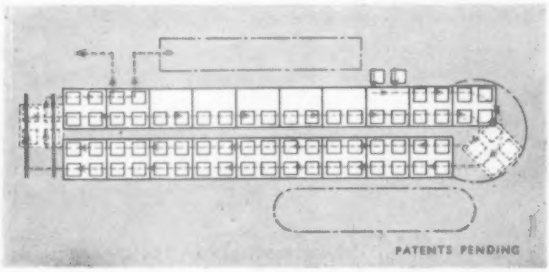
Unique and Practical

"Double MLC" Mould Handling System

Snap or tight flask moulds are set out in outside position on the car, poured, and travel almost completely around the loop. They are then transferred automatically to inside position on the car, and continue around the loop again for automatic removal at the shakeout. These new systems provide almost twice the cooling time of a conventional mould conveyor carrying only a single line of moulds; effecting substantial savings in floor space, equipment, building, and other facilities.



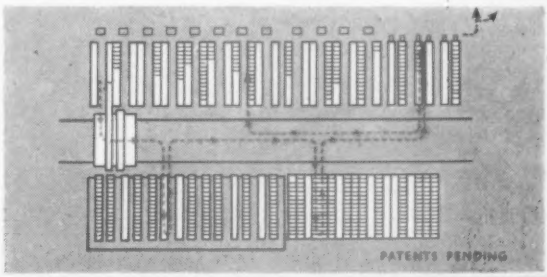


"Double MRI" Mould Handling System

Rectangular loop, consisting of two straight runs connected with a rotary turn and transfer car. Cars advance one car length, then remain stationary for timed period so large moulds can be loaded onto the conveyor, poured, and the moulds removed, while the conveyor is stationary. Moulds are carried side by side on the cars and make almost two complete trips around the loop, thus nearly doubling the cooling time per square foot of floor space.

"MF" Mould Handling System

Unlimited flexibility for jobbing foundries. The transfer car delivers pallets loaded with similar moulds, to the pouring, cooling, and shakeout zones, and returns the pallet with the bottom boards and bands—or flasks—to the moulding area. Handling similar moulds together permits moulds for different castings to be kept separate, and even poured with different metals, without interfering with other groups of castings. Slow jobs do not hold up the fast jobs. Moulding, pouring, cooling and shakeout are centralized, minimizing the equipment requirement.



Write today for a copy of Bulletin No. 135. It gives full details about eight different types of Bartlett-Snow Mould Handling Systems.

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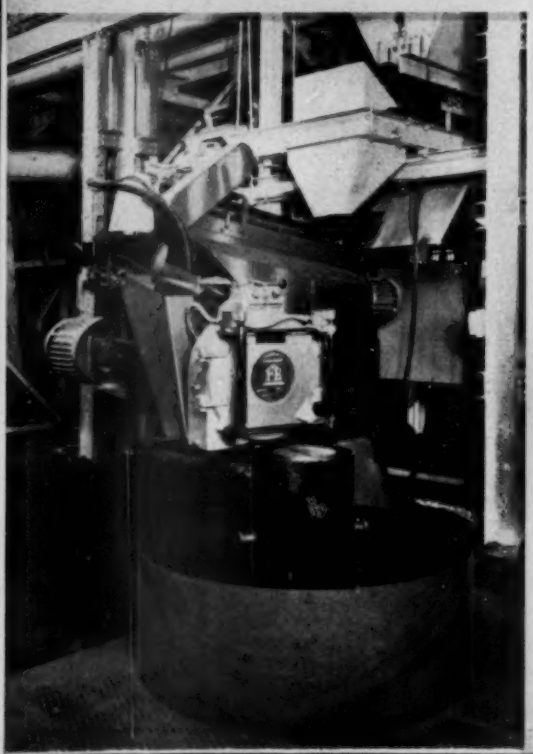

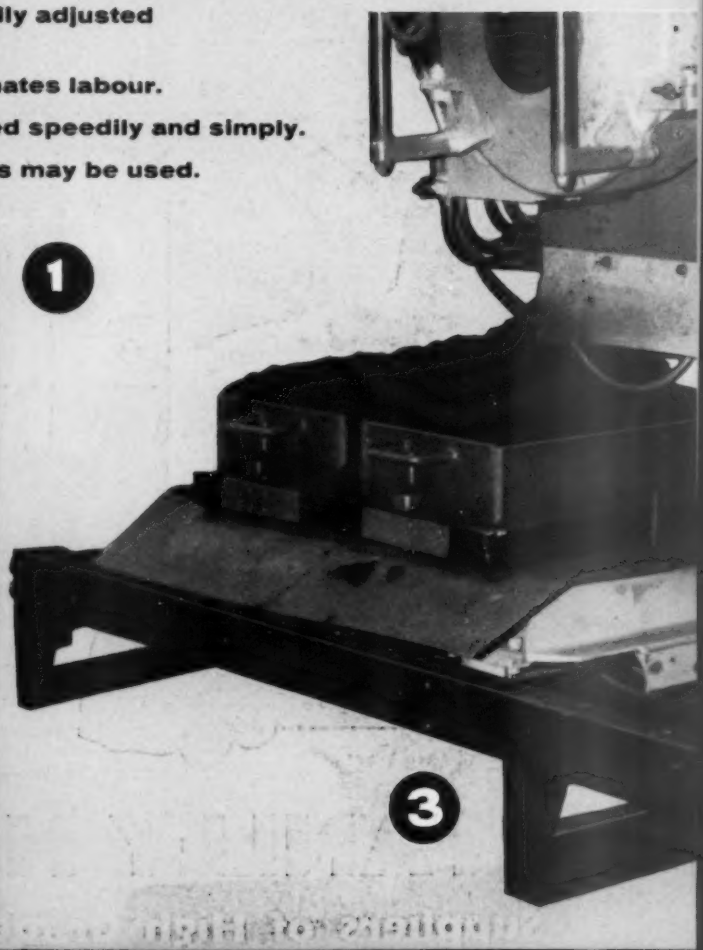

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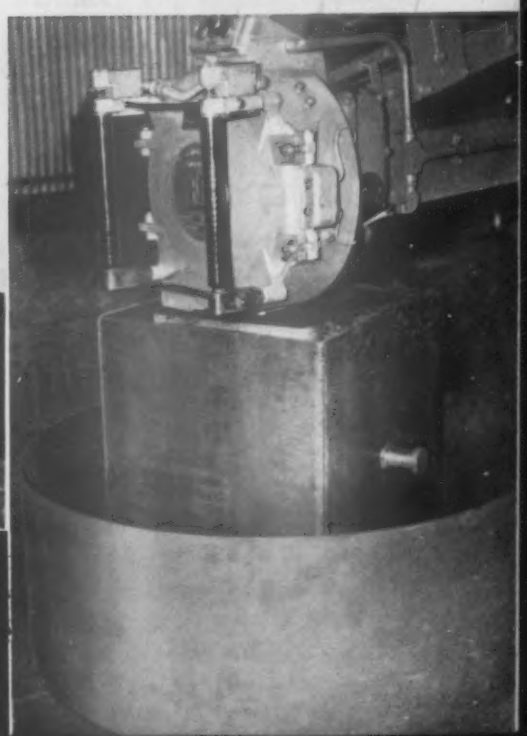

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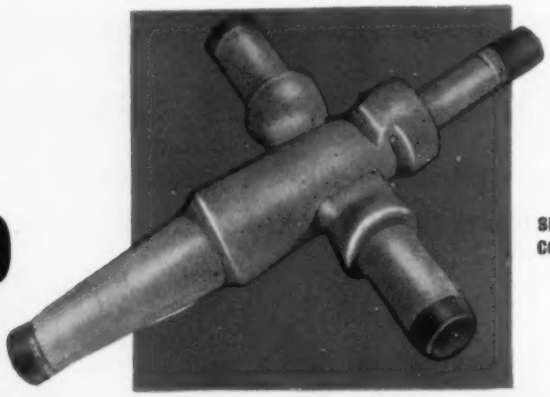

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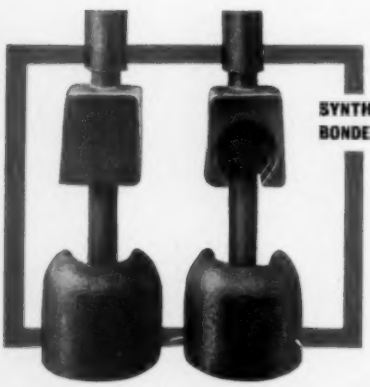

SYNTHETICALLY BONDED CORE

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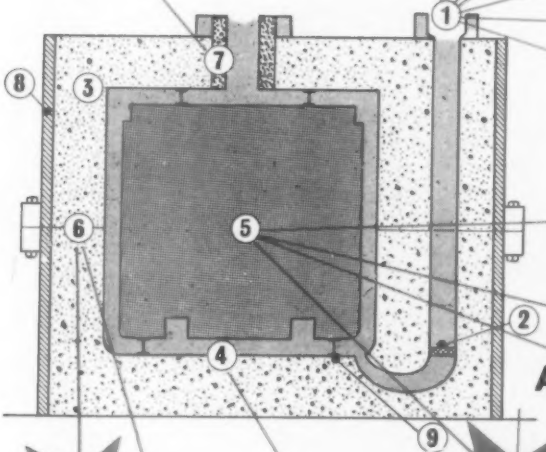

Key to Sectional Drawing of Mould

		Send for booklet No.
1	Metallurgical Control use of Fluxes	3
2	Clean Metal by using Ceramic Strainer Cores and Discs.	4
3	Coal Dust additional to Facing and Backing Sand	1
4	Silverskin Blackings, Plumbago and Mould Dressings.	1
5	Cores using Crulin and Crudol Core Binders (Oil Bonded, Air Setting Cereal or CO.2 Binders).	2
6	Moulds Parted with Beecro Silica Free Parting Powder or Beecrol Parting Liquid.	1
7	Casting Feeding with Alsica Exothermic Feeder Heads.	4
8	Moulding Boxes supplied by B.F.U. Chaplets, Studs, etc.	5

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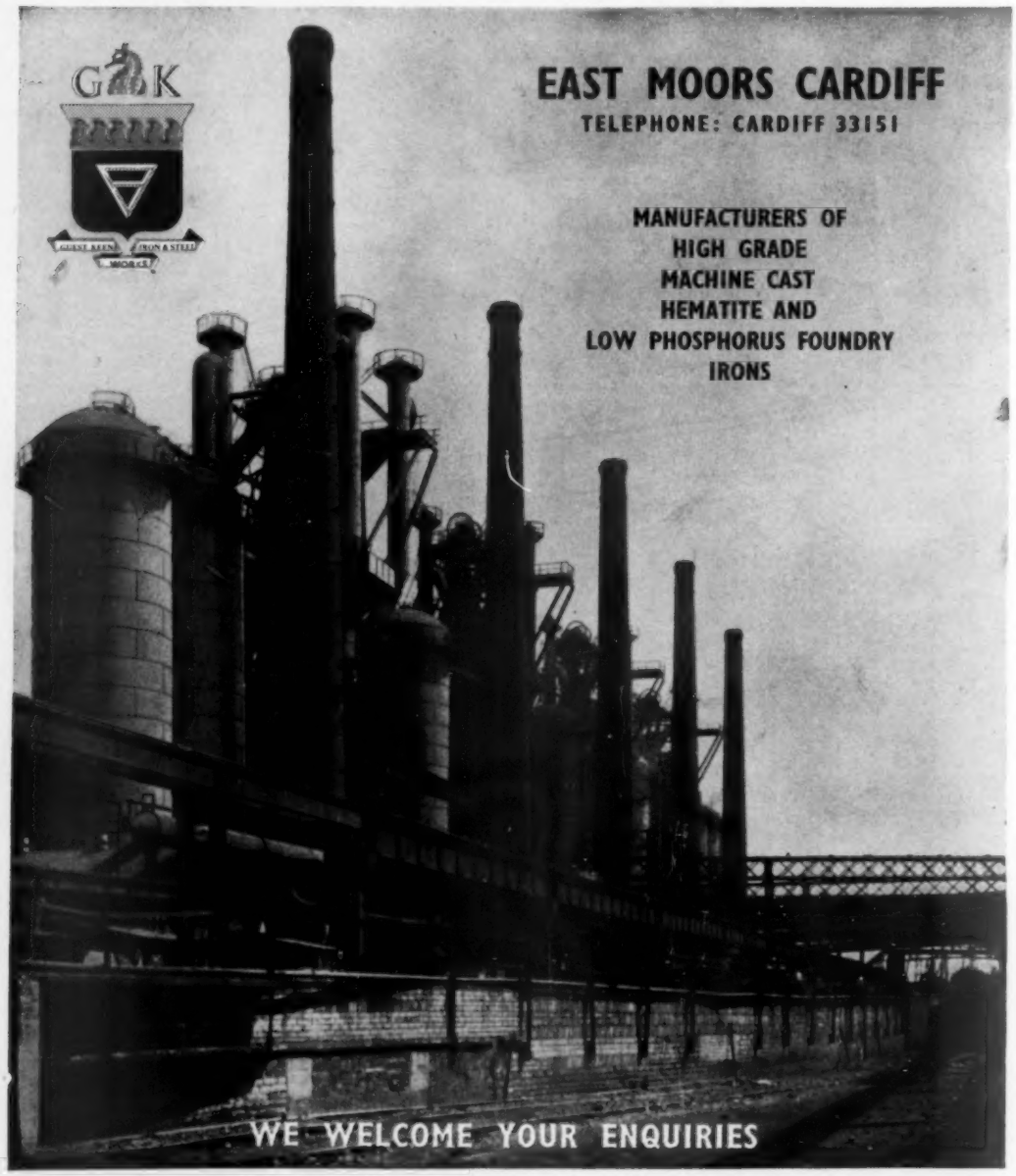

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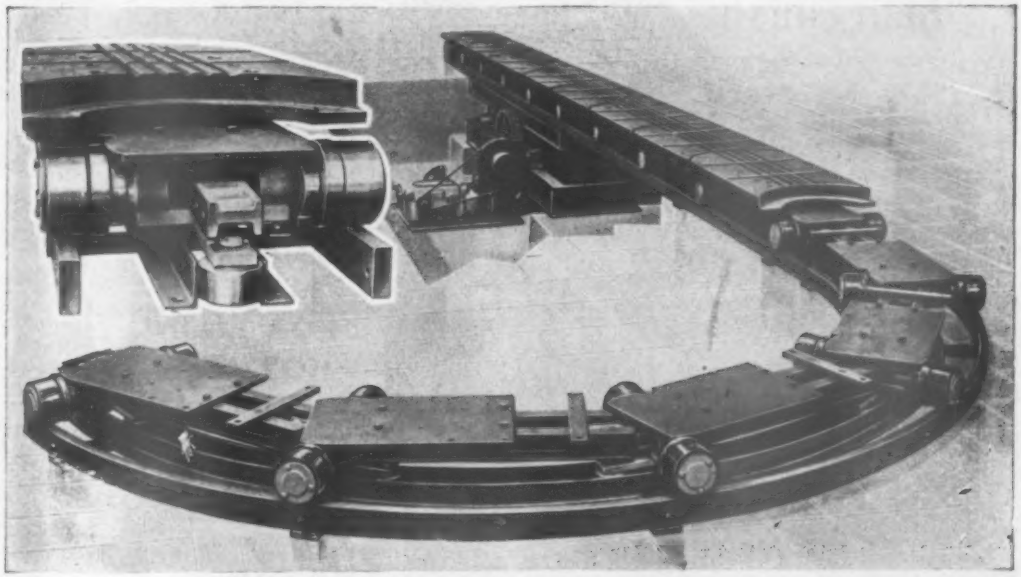
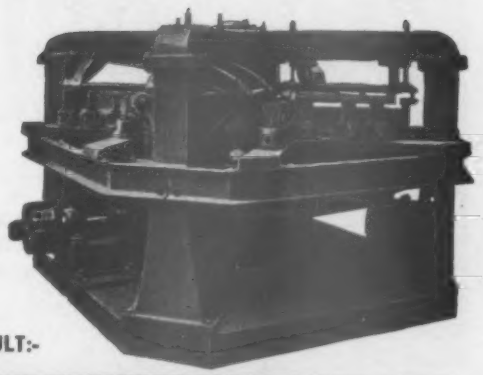


TYPICAL MOULD CONVEYOR SHOWING SOME C.I. PLATES REMOVED, ALSO DETAILS OF AXLES. SIZES TO REQUIREMENTS



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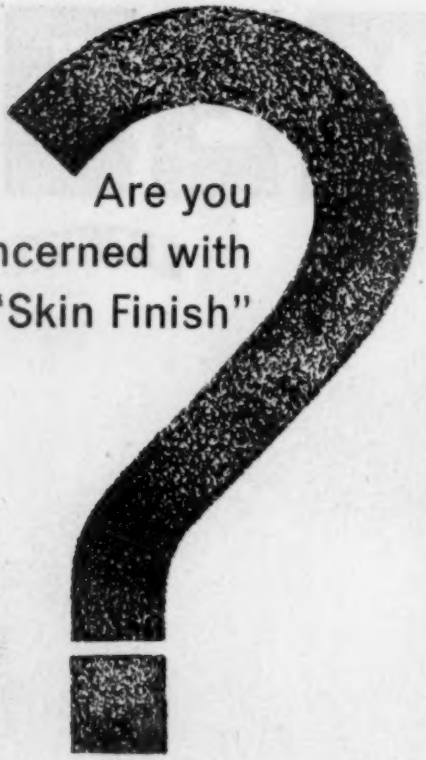

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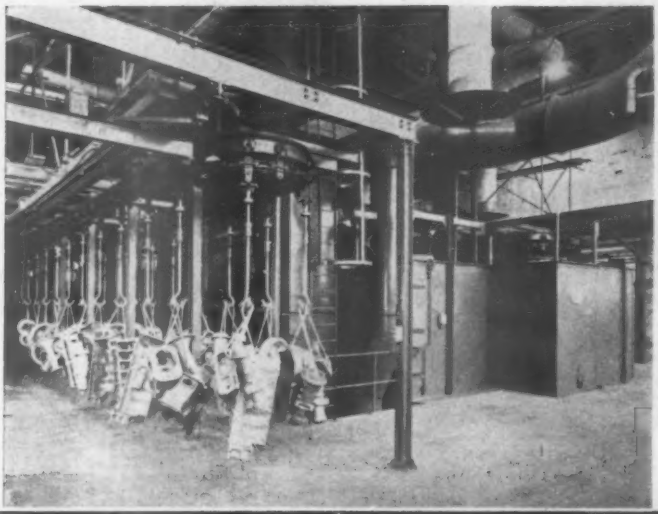

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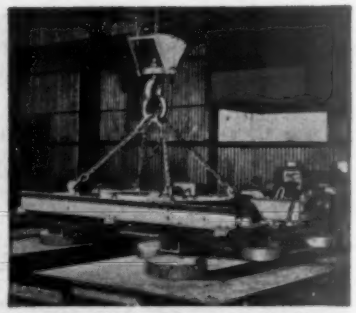

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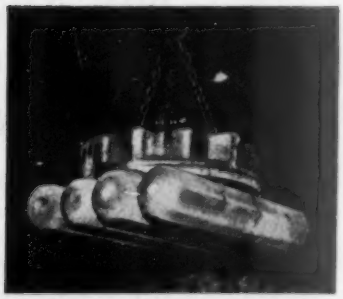

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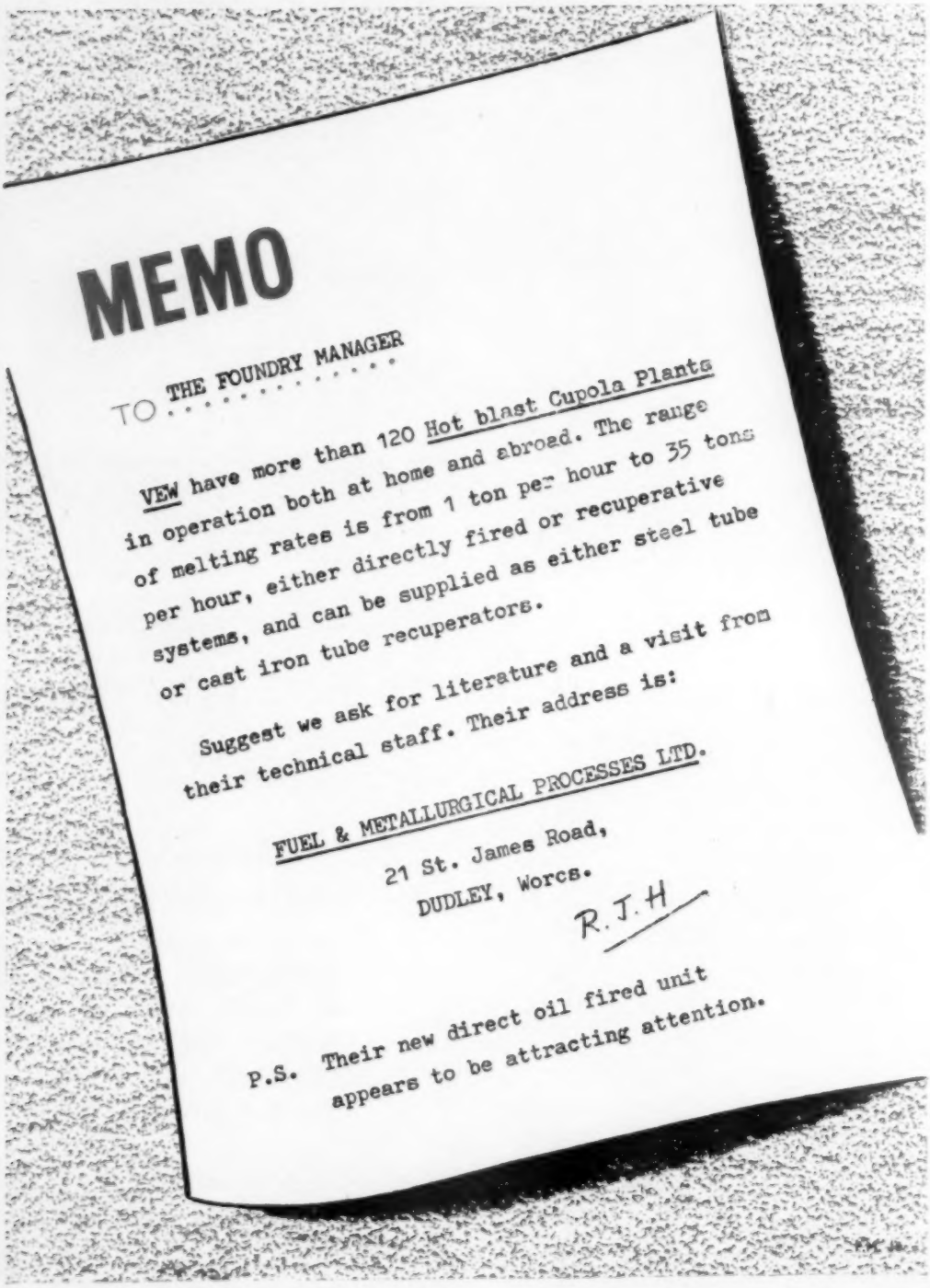

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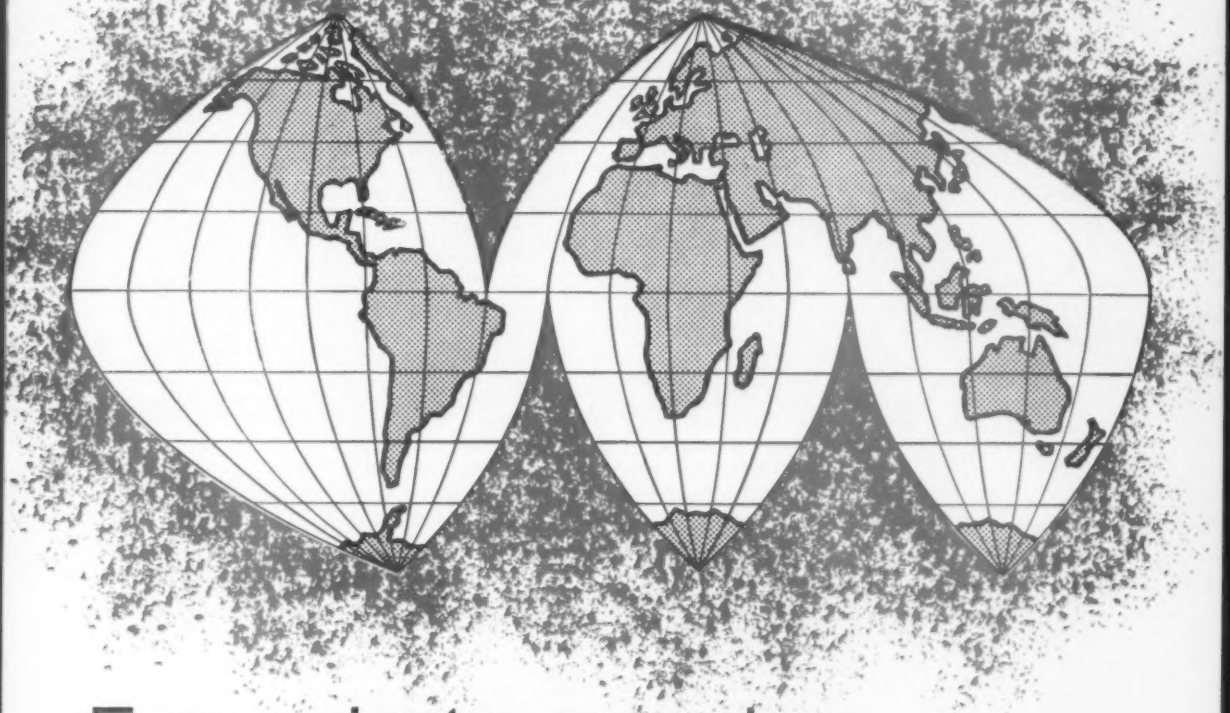

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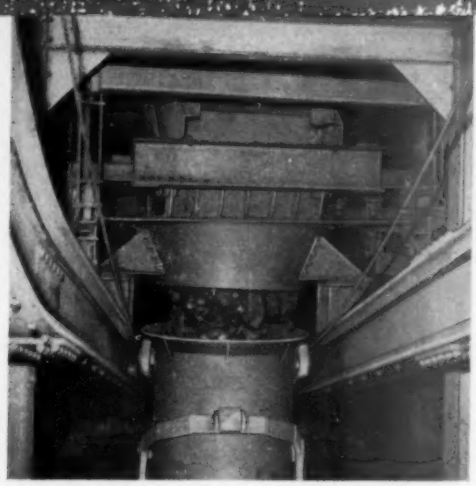

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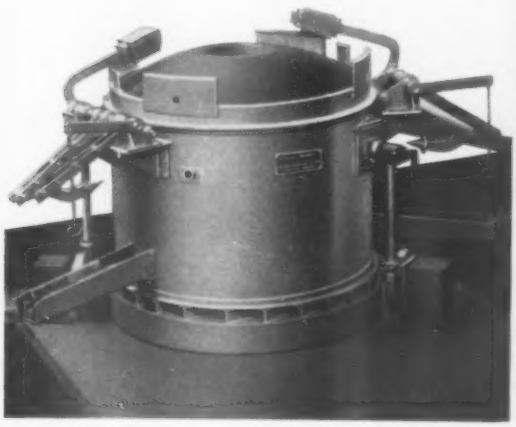

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(*Below*) Coke hopper, floor weigh hopper and stock bins, for swivel charger serving 8-ton-per-hour cupolas.

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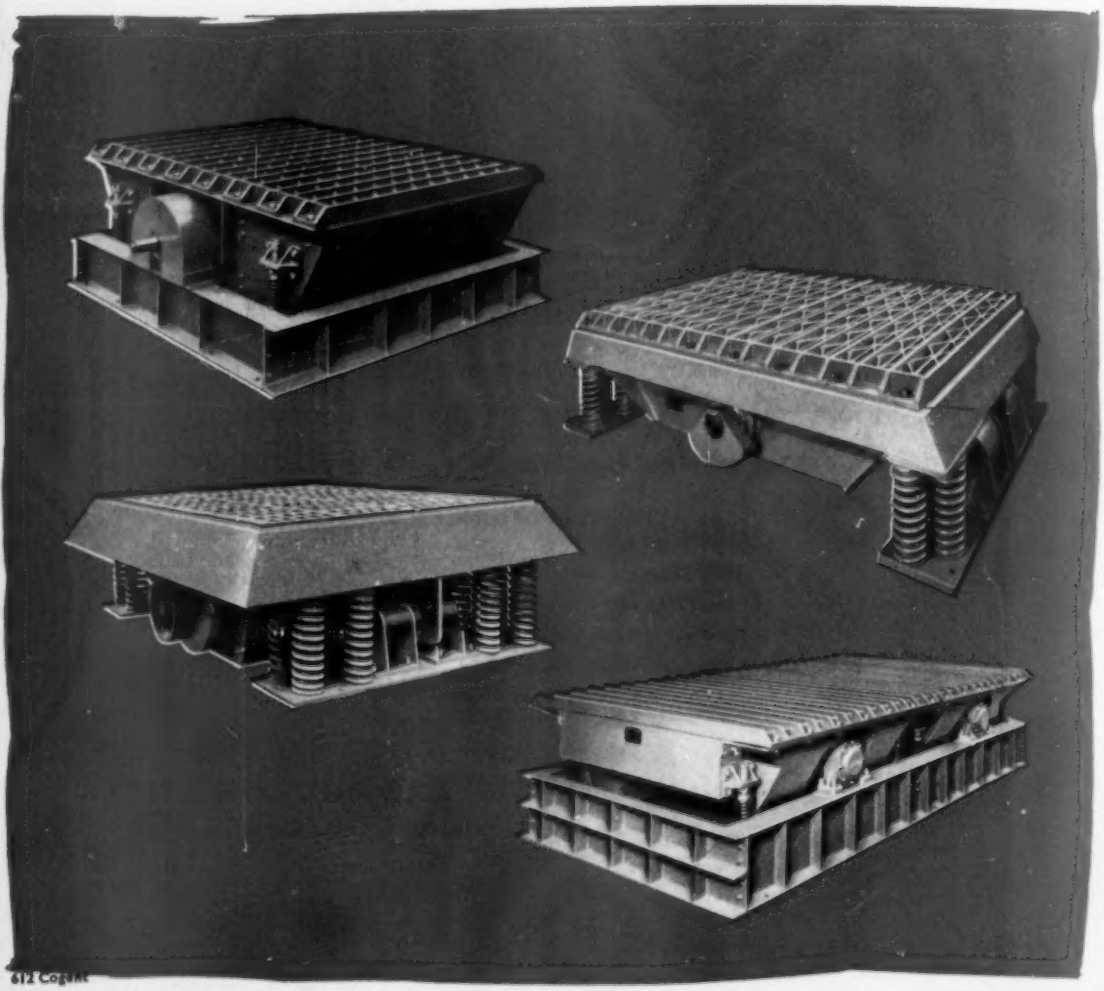

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PRINCIPAL CONTENTS

PAGE

American Foundry Technology
Digest of a variety of topics dealt with in recent American literature .. 219

Bulgarian Foundry Industry
Survey of rationalization and rehabilitation plans 229

Positioning and Supporting Cores in Moulds
By "Tubal Cain"
Practical "know-how" with regard to the secure fastening of cores in mould production 231

Technologie de la fonderie américaine. Condensé d'une série de sujets approchés dans des articles américains récents. 219

L'industrie de la fonderie bulgare. Etude des plans de rationalisation et de réhabilitation. 229

Mise en place et soutien des noyaux dans les moules. Par "Tubal Cain." Compétence pratique avec en vue, l'attachement sûr des noyaux dans la production de moules. 231

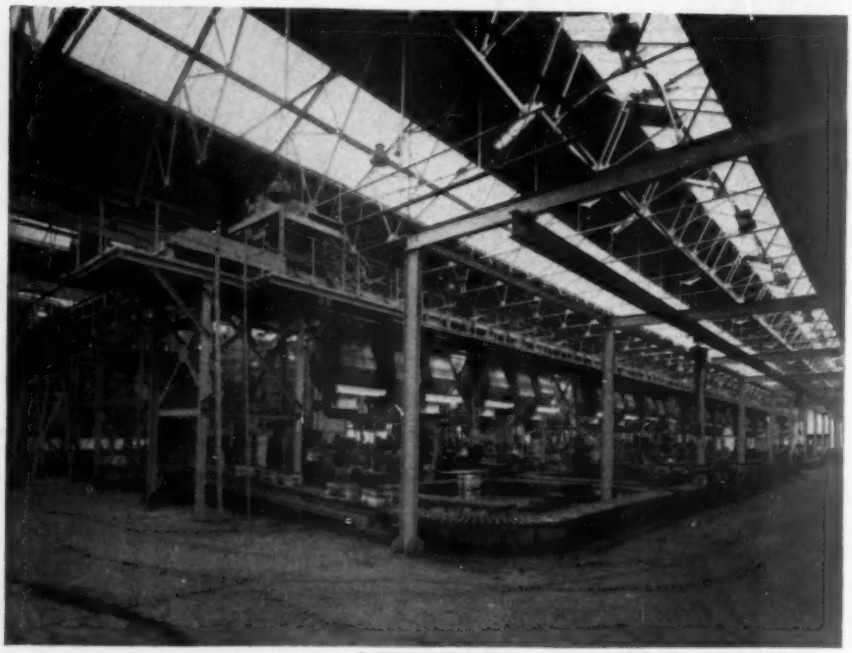
Amerikanische Giessereitechnologie. Eine Sammlung einer Anzahl kürzlich im amerikanischen Schrifttum behandelter Themen, die von augenblicklichem Interesse sind. 219

Die bulgarische Giessereiindustrie. Übersicht über die Pläne für Wiederaufbau und Rationalisierung. 229

Lagebestimmung und Stützung von Kernen in Gussformen. Von "Tubal Cain." Die praktische Geschicklichkeit, welche zur sicheren Befestigung von Kernen bei der Herstellung von Gussformen notwendig ist. 231

Features, News, Commercial Information and Statistics

Leader: Conditions in Steel Foundries 217
Hungarian Foundry Congress 218
Foundry Studies at Wolverhampton 218
US Steel Foundry adopts All-electric Melting 234
ESC's 90-ton Electric-arc Furnace 234
Notes from the Branches 235
Equipment and Supplies 237
Personal 239
Company News 240
New Patents 240
News in Brief 241
Raw Material Markets 244
Exhibitions 244
Current Prices of Iron, Steel, and Non-ferrous Metals 246
Translation Services 248



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FOUNDRY
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Conditions in Steel Foundries

The First Report* on Conditions in Steel Foundries of the Joint Standing Committee, which has been in existence some nine years, is a veritable textbook on the amelioration of working conditions, not only in steel foundries, but of the making of castings in any alloy. Usually, this type of publication enables the reader to forecast future factory legislation, but here instead are given fairly obvious promising lines of action. They are: (1) A higher standard of housekeeping, especially about the provision and maintenance of better floors and gangways, with particular attention to obstructions, permanent and temporary, on such floors and gangways; (2) wider provision of suitable protective clothing and other protective devices; (3) the proper care and use of such equipment by workpeople; (4) early first-aid treatment for all injuries; (5) better instruction in safe methods and practices in manual weight-lifting and also in the handling of loads by cranes and other hoisting appliances. To attain these objectives, but two features are essential—enthusiasm for accident prevention—extending from the boardroom downwards throughout management—and wholehearted co-operation from workpeople.

The chief contents of the Report are interesting short reviews of the work which has been done and previously published by the Committee, and we specially commend their careful scrutiny by our overseas readers. In many cases, the scope of the investigations and results attained are in the van of modern factory legislation and conduct in other countries. Overseas employers' organizations are, for the most part, much " tidier " than ours, but here there is a case where the British Minister of Labour has the advantage of close co-operation with the employers' federation, trade unions, research associations, scientific institutes, and technical Press. The problems encountered and dealt with in the Report are truly comprehensive and set out in no fewer than 27 appendices. Moreover, each shop and item of plant normally used is separately dealt with, so that within the compass of one book all the germane information has been assembled and carefully expounded.

In general, the staffs of British steel foundries will be fairly familiar with these developments, but the personnel of the other sections of the foundry industry and overseas executives too will be able to see for themselves exactly what has been the progress registered and the problems still to be resolved. In many cases, they will see just what action they can take to improve conditions in their own shops, with cumulative beneficial effect on the foundry industry of the world.

* "Conditions in Steel Foundries". Published for the Ministry of Labour by Her Majesty's Stationery Office, York House, Kingsway, London, W.C.2; price 10s. net (UK postage 1s.).

Hungarian Foundry Congress

The foundry section of the Hungarian Mining and Metallurgical Society is arranging a Foundry Congress to take place at Budapest during the week September 18 to 22 inclusive. In general, following a reception of foreign delegates on the Sunday evening, the proceedings proper will commence on the Monday morning with an opening address by the Minister of Mining and Engineering, followed by a festival lecture. Technical sessions will take up the rest of Monday and these will also be held all day Tuesday and Wednesday. On Thursday, there will be two groups of works visits in the Budapest area and on the final day of the Congress (Friday), further visits have been arranged to foundries in the provinces, delegates travelling by motor-coach. Of the few papers to be presented by authors from Western Europe, one is to be given by Dr. D. V. Atterton, M.A., managing director, Foseco, Limited, Tamworth, Staffs.

Programme Details

Monday, September 18

After the opening address and festival lecture, the following papers will be presented*: Session I: (1) Contribution from the USSR; (2) "Heating and Ventilation in Foundries," by A. Orolin; (3) "Exothermic Moulding Materials," by Dr. D. V. Atterton, and (4) a paper by a member of the host country.

Tuesday (two simultaneous sessions II and III), 9 a.m. to 1 p.m. and 2.30 p.m. to 5 p.m.

Session II: (5) "Improving the Quality of Malleable Cast Iron," by E. Chapo; (6) "Modernization of Machine Moulding at the Csepel Iron and Steel Foundries," by L. Kalman and I. Szilagyi; (7) "Mechanization of Foundrywork," by A. Toth; (8) "Modern Foundry Equipment in Hungarian Foundries," by O. Szenes and A. Arday; (9) "Operation of the Sandslinger," by a Russian lecturer; (10) Paper by a representative of George Fischer A.G., Switzerland, and (11) "Technology and Economy of Die-cast Grey Iron," by a lecturer from Eastern Germany.

Session III: (12) "Consequences deriving from the Heat Balance of Cupola Operation," by F. Varga; (13) "Experience gained in One-year's Operation of a Hot-blast Cupola," by R. Wortmann; (14) "Cold- and Hot-blast Cupolas," by E. Vörös and F. Varga; (15) "Estimation of the Quality of Molten Cast Iron under Changing Requirements," by M. Csiszar; (16) "The Ulmer Hot-blast Cupola," by a Polish lecturer; (17) "The Hot-blast Cupola," by a lecturer from Eastern Germany, and (18) "Production of Rolls of Hyper-eutectoid Steel," by Z. Nagy.

Wednesday (two simultaneous sessions IV and V)

Session IV: (19) "Experience of the Mechanization of Coreshops," by I. Felhosi; (20) and (21) two papers by representatives of the Western Germany Röperwerke organization; (22) "Experience with Coreshooters and Coreboxes for Them," by G. Szavat; (23) "Experiments with Domestic and Foreign Sodium-silicate Solutions," by T. Budinszky; (24) "Binders for the CO_2 Process," by O. Racz, and "Control of Metal Melting as a Basis for Goodhousekeeping in a Non-ferrous Foundry," by K. Rutkowsky.

Session V: (26) "Solidification of Castings in a Sand Mould," by S. Kalman; (27) "Interdependence of Composition and Shrinkage of Cast Iron," by G. Nandori; (28) "Influence of the Mould on the Solidification of Metals," by S. Blasko; (29) "Experiments with a Self-hardening Copper-containing Aluminium/Silicon Alloy," by K. Maréchal and G. Grüll; (30) "Substitute Metals for Tin-bronzes," by B. Padar; (31) "Light-alloy Castings," read by a lecturer from Eastern Germany, and (32) "Reducing Processing Time in Patternmaking," by A. Pal.

The closing session will take place on Wednesday, September 20 at 5.30 p.m.

Although the date set for receipt for applications has already expired, it is possible that latecomers from foreign countries may still be accepted. These should get in touch immediately with the organizers at Szabadsag Ter 17, Budapest V, Hungary, and make travel arrangements through the IBUSZ Travel Agency, Felszabadulas ter 5, Budapest V. Two photographs (not older than six months) and size 40 by 60 mm. are required for the visa application and visitors' passports must be valid for journeys to Hungary.

* Provisional arrangements

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The joint facilities of the College of Technology and the National Foundry College at Wolverhampton offer wide educational opportunities for the apprentice, trainee and student of foundry practice and its related subjects, leading to:—ordinary and advanced certificates of the City and Guilds of London Institute, in foundry practice, patternmaking, engineering planning, estimating and costing, Higher National Certificate in foundry metallurgy and the Diploma and Advanced Diploma of the National Foundry College.

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For Foundry Technologists

Higher National Certificate in Foundry Metallurgy: Two years study leading to the award of the Higher National Certificate in foundry metallurgy, the subjects covered in the course including:—properties and applications of metals; physical chemistry and applied physics for metallurgists; engineering and engineering drawing; foundry practice and technology. The first year of the course is common with courses leading to the examinations of the Institution of Metallurgists.

All of the above courses are available to part-time day and/or evening-only students.

For Foundry Technologists and Executives

Advanced Diploma of the National Foundry College: Three years sandwich course, studying physics, chemistry, mechanics and/or drawing, metal-forming processes, foundry and patternshop processes, physical metallurgy, fuels, refractories, structure of the industry and foundy management.

Diploma of the National Foundry College: Two years full-time course, studying foundry metallurgy, technology, and management.

American Foundry Technology

Probably with more urgent reason now than in the past it is necessary for the British foundryman to keep abreast of developments abroad. Wherever problems common to the industry are discussed and solutions suggested, the fruits of such work should be made available here. Foundry technology is well advanced in the United States, and the interests that are exercising the minds of its technicians will be bound to find an echo to some extent in this country. The following digest of American papers covering a wide range of foundry topics is presented below to cater for this need. To enable readers to refer, if necessary, to the original publications reference is made to each source.

Different Irons from one Cupola Melt*

By F. E. Kasch

There are several ways in which a foundry can produce different types of iron from a single cupola melt: (1) By changing the metallic charge during the course of the melt; (2) by changing the operating conditions in addition to changing the charge; (3) by changing the composition in the ladle by the addition of alloys and carbon or by removal of sulphur or other elements, and (4) by changing the composition of a portion of the melted metal in another type of furnace. Many foundries find it expedient to change only the ingredients in the metallic charge to alter the composition of the iron, and to pour off the "changeover" iron in non-critical castings. An extra split of coke or two is usually used between the different charges to effect a better separation. In a 54-in. dia. cupola melting 11 tons per hr., the recognized changeover will probably average 10 to 15 min., involving approximately 2 tons of iron or more to be disposed of in non-critical castings. Hence, three types of iron are involved, *i.e.*, the original iron, the changeover iron and the new iron. Timing, weighing and testing are the three most important controls available.

Changing Charge

Having observed the melting rate of the cupola on previous days and for the half-hour or so prior to the "new charge" time, a good estimate can be made of the time to expect the new iron at the spout. Weighing all "taps" of metal can also be of considerable assistance in this matter. Frequent checks or tests must also be made on the iron coming from the spout. Usually a properly-made chill or wedge-fracture test can distinguish between most types of irons and such a test is economical and relatively fast. Rapid carbon determinations can be used to "back up" the chill test. Chill depth indicates carbon equivalent—if the grey portion is examined closely, some estimate can also be made of the carbon content and the silicon by difference. (Table 1).

Complete Melting

The most thorough way to control and separate different grades of iron in the cupola is to melt one grade completely before charging the next. In between grades, shut off the air and drain the cupola of all iron and most of the slag. The bed is then rebuilt to proper height, the new metal is charged and the air turned on again. Extra coke can be put on top of the last charge of the original iron and the air blast reduced proportionately as the stack empties; this minimizes excessive refractory burn-out while melting the last metal of the original iron mix. This method of separation is practically a necessity when switching from grey cast iron to high-alloy white iron or the higher-alloy austenitic grey irons. Since this method sharply separates different irons almost completely, it is highly recommended for changing from soft-iron grades

* Abstract of article appearing in *Modern Castings*. The Author is foundry engineer, Gray Iron Research Institute, Inc., Columbus, Ohio.

TABLE 1.—*Record of Melt in which Class 35 Iron was followed by White Iron.*

Type of iron.	Sample number.	Time.	Total chill.	Clear chill.	Per cent. T.C.	Per cent. Si	Per cent. steel.	Blast volume, cub. ft. per min.	Blast press, oz.	Melt rate, tons per hr.	Total, tons.
Class 35	1	2.21	13	10	3.36	2.08	45	8,000	24	15	16
.. ..	2	2.24	15	10	—	1.89					
.. ..	3	2.27	17	15	3.26	1.93					
.. ..	4	2.32	20	16	—	1.76					
.. ..	5	2.35	26	20	—	1.72					
.. ..	6	2.38	24	20	3.40	1.65					
Transition	7	2.45	30	24	—	1.65					
White	8	2.49	—	—	3.54	0.98	45	5,000	14	10	11
.. ..	9	2.54	—	—	—	0.45					

Note: 1 48-in. dia. cupola, 2,000 lb. charges, 64-in. initial bed, front slagging spout (1,000 lb. capacity). 3,000 lb. ladle. 2 Coke splits, 260 lb. for grey iron, 200 lb. extra between grey and white iron, 190 lb. for white iron. 3 Estimated change-over, 10 to 15 minutes—3,000 to 4,000 lb. of metal.

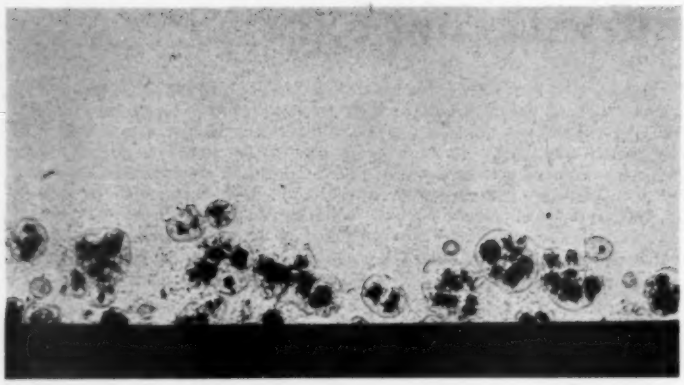


FIG. 1.—*Inclusions near the drag surface of part of a ZH62A alloy casting. (Unetched ×7.)*

to stronger ones. Counting the slightly-reduced melting rate with temporarily-reduced air, plus draining the well, and measuring and rebuilding the bed and recharging two-thirds or more full, the lost melting time for the cupola can usually be held to 30 min.

Separation Aids

Several things can be done to assist in changing from one type of iron to another. They are: (1) Run a lower blast-rate to narrow the melting zone; (2) the first charge or two of the new iron could contain heavier and chunkier pieces to slow down the melting rate of the new mix. (3) Small coke can be used for the split or double split to help physically to keep the charges apart in descent; the small coke should also delay the start of melting. (4) The height of the bed should be increased and the coke to iron percentage ratio to raise the carbon; leaner ratios are used to lower the carbon. A low-carbon malleable-iron type of coke of higher ash-content can also be used on the split and some or all succeeding charges if it is desired to lower the carbon; the reverse is carried out to change to higher carbons. (5) When only a small amount of high-carbon iron is required, run it at the start of the melt if possible, as the first part of the cupola melt is almost invariably higher in carbon.

Ladle Treatment

In addition to the methods outlined for changing the composition in the cupola itself, ladle treatments of the molten iron can be utilized. Besides purely inoculating additions, alloys can be added to various ladles while filling with the base iron, and silicon, chromium, nickel, molybdenum, copper, vanadium and other elements are regularly added. Amounts depend on the ladle batch size, the initial temperature of the iron, and the final temperature allowable from the standpoint of pouring. Additions of up to 2 per cent. total of alloy by gross weight and sometimes up to 3 per cent. are common practice.

Duplexing

Another smaller auxiliary arc furnace, such as an electric-arc furnace, in conjunction with the cupola, can be used to change the composition of a portion of the metal. Most changes are made by simple dilution with steel or pig-iron or by addition of alloys.

There are many ways open to the foundry for changing types of iron in the course of a single cupola melt. The types of irons to be made, materials available and production and economic conditions will determine the useful methods for a particular situation.

Inclusions in Magnesium-alloy Castings*

By B. Lagowski and W. A. Pollard

Three types of inclusions found in EZ33A and ZH62A† magnesium-alloy castings were examined by radiographic, metallographic, X-ray diffraction and spectrographic techniques. Type 1 inclusions near the drag surfaces of the alloy castings ex-

* Abstract of paper published in the January, 1960 issue of *Modern Castings*. The Authors are scientific officers of the physical metallurgical division, mines branch, Department of Mines and Technical Surveys, Ottawa, Canada.

† EZ33A—Zinc 2 to 3 per cent.; Zr ½ to 1 per cent.; rare earth 3 to 4 per cent., balance Mg. ZH62A—Zinc 5 to 6 per cent.; Zr ½ to 1 per cent.; Thorium 1 to 2 per cent., balance Mg.

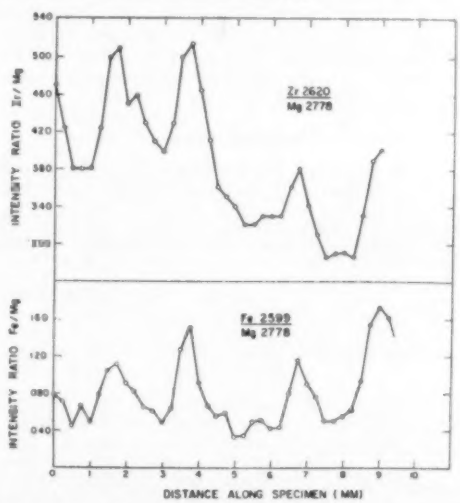


FIG. 2.—*Results of a microvolume traverse across a region of an EZ33A alloy casting containing type 2 (iron-rich) inclusions. Note the close parallelism of the iron and zirconium curves.*

amined were revealed by grinding off a small amount of the surface metal. Each defect was visible to the unaided eye as a black speck surrounded by a roughly circular, light-coloured zone bounded by a darker ring. Fig. 1 shows these features at low magnification. At higher magnifications, the defects were usually seen to contain one or more transparent crystalline particles associated with colonies of eutectic-like structure.

Early in the investigation, the appearance of the transparent crystalline particles suggested that they were the remains of sand grains which had reacted with the melts. Metallographic examination of sections of the original and the synthetic inclusions showed that the eutectic-like structure associated with the silica particles was made up of two phases which usually occurred in the form of alternate, parallel lamellae, but sometimes in more-complex patterns. One set of lamellae was blue-grey and the other brown. Farther from the silica crystal, the blue-grey constituent tended to form massive crystals, and its place between the brown lamellae was taken by magnesium solid solution.

X-ray diffraction examination of a sample taken from the large amounts of reaction products was shown to contain magnesium oxide and magnesium silicide (Mg_2Si) in addition to unreacted silica and magnesium. Spectrographic analysis strongly suggested that the shell around the inclusions was composed of compounds of zirconium, thorium and possibly zinc, with silicon and magnesium. The results also confirmed that the silica particles had reacted with the molten alloy.

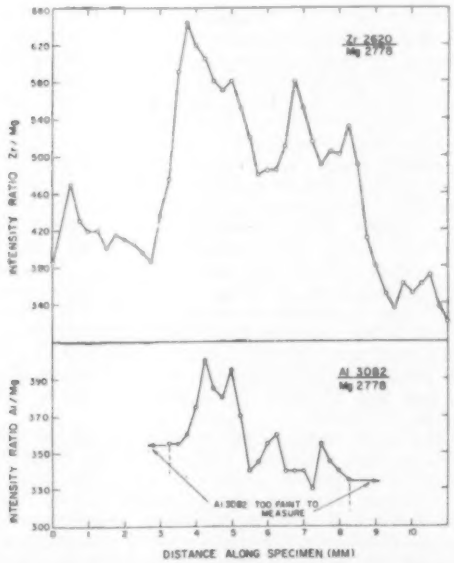


FIG. 3.—*Results of a "microvolume" traverse across a region of an EZ33A alloy casting containing type 3 inclusions. There is a definite relationship between the aluminium and zirconium curves, but this is less pronounced than for type 2 curves.*

Type 2 and 3 Inclusions

Type 2 inclusions were observed in radiographs of commercial EZ33A alloy castings and type 3 inclusions were found near feeder-heads in which exothermic sleeves had been used. Inclusions of types 2 and 3 could not be seen by the unaided eye.

In type 2 inclusions, the only elements found at levels above those in the matrix were iron and zirconium. Fig. 2 shows the variations in the intensity ratios of iron/magnesium and zircon/magnesium, and it will be seen that there is a distinct parallelism between the two curves. The results of the microvolume traverse on a group of type 3 inclusions are shown in Fig. 3. In this case, aluminium and zirconium were the only segregated elements. The experiments and examination described led to the conclusion that type 1 inclusions were caused by entrained sand grains which had reacted with the melt. These probably came from those parts of the mould surface over which there was a considerable flow of metal, for example, the gating system.

Another factor which might lead to loose particles of sand in the mould is disturbance of the mould after it is made such as, for example, during the placing of steel wool for skim gates.

Type 2 inclusions are thought to be particles of an iron/zirconium compound, but the source of the iron was not determined. One possible source is the steel-wool filters which are used in some gating systems.

Type 3 inclusions are probably aluminium/zirconium particles produced by the reaction of aluminium (from exothermic compounds) with the melt. They are only likely to be found when these compounds are used.

The results showed that the inclusions of the first type were caused by entrained sand grains, those of the second type by iron/zirconium compounds and those of the third type by aluminium/zirconium compounds.

Cupolas and Steelmaking

A resurgence of interest in cupola melting as the initial stage of large-scale steelmaking has developed from the emergence of reliable controlled hot-blast cupolas producing large tonnages almost continuously. Recent documentation of such developments is carried a stage further by the recording in *The Whiting Founder* (published by Whiting Corporation, Harvey, Illinois, USA), of an article describing the set-up at Acme Steel Company* of Chicago, from which the following abstract is taken.

By many standards, the Acme Steel Company's steel plant in the Chicago suburb of Riverdale, is an exceptionally up-to-date steel plant. Besides

* The Acme Steel Company have employed Whiting cupola equipment for their bulk melting plant—UK licensees, Incandescent Heat Company, Limited, Cornwall Road, Smethwick, Birmingham.

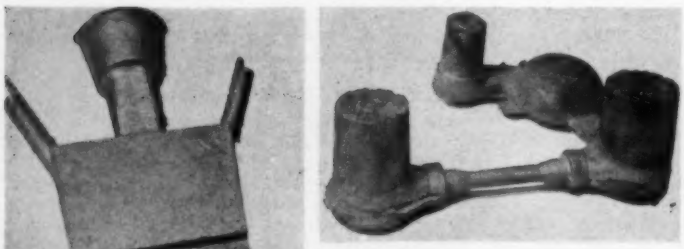


FIG. 4.—*Photograph showing gating and pattern design of core-moulded (left) and shell-moulded (right) tensile bar castings (shell-moulded versus core-moulded test-bars for bronze).*

being completed recently, the plant is new in that it combines two tested means of processing metal—hot-blast cupolas and top-blown basic oxygen furnaces—into a single installation. The decision to build the new plant came as a result of the company's continued growth which was being hampered by inadequate and often unreliable supplies of semi-finished steel needed to manufacture Acme's diverse products.

Plant Details

The heart of the entire operation at the Acme Steel Company is a pair of Whiting hot-blast cupolas, having inside diameters of 156 in. at the baseplate and 114 in. at the hearth, and which are as tall as an eight-storey building. Plate 1½-in. thick was used for the body and stack shells and 2-in. plate for the bases. They accommodate a charge stack 40-ft. high compared with a 25-ft. column of raw materials in typical cupolas. Both units are externally water-cooled in the melting zone and stack, thus requiring no lining except in the well. They are equipped with copper, water-cooled, blast-furnace tuyeres and are fitted with a Whiting-Thermo recuperative hot-blast system delivering 650 deg. C. air at rates up to 40,000 s.c.f.m. A split wind-valving system makes it possible to operate both cupolas simultaneously.

Metallic charge make-up is handled by magnet-equipped mill cranes loading components into a pair of Whiting 240 cu. ft. batch weigh-hoppers. Coke, limestone, and fluorspar are stored in overhead bins and predetermined amounts of these are deposited into a 125 cu. ft. motorized batch weigh-lorry by means of vibrating feeders. The lorry, in turn, loads the charging buckets. The charge components vary with the amount of molten metal being produced. For example, when melting at capacity—50 tons per hr.—the charge consists of 48 per cent. pig-iron and scrap, 52 per cent. steel scrap, 20 per cent. foundry coke, 6 to 7 per cent. limestone and 1½ per cent. fluorspar. When melting at 25 tons per hr., the charge is made up of 90 per cent. No. 2 heavy melting steel, 10 per cent. pig-iron, 25 per cent. blast-furnace coke, 6 to 7 per cent. limestone and 1½ per cent. fluorspar.

Actual charging is accomplished by means of two Whiting 15-ton steel mill trolleys, one serving each of the two cupolas. After a bucket has been filled it is lifted and moved over the top of the cupola by the trolley. The bucket is then lowered into a gas lock at the top of the cupola, a cover then seals the lock over the top of the bucket, and doors at the bottom of the lock under the bucket open, permitting the charge to drop into the cupola. This arrangement enables a top pressure in the cupolas to be maintained as high as 15-in. water gauge. This results in the recovery of most of the cupolas' heat and eliminates the escape of dust and smoke from the top of the cupolas, reducing melting time and cutting coke consumption.

Gases are withdrawn from the cupolas and are used to fire the hot-blast system. Before entering the system's recuperator, however, these gases are thoroughly cleaned in a combination mechanical and electrical scrubber. Using cyclones, a tower washer, and an electrical wet-pipe-type precipitator, the equipment is designed to be 99.75 per cent. efficient. A 20-ton, 35-ft. span crane services the hot-blast equipment.

Tapping

The cupolas are tapped directly into two 200-ton Whiting hot-metal mixers, one serving each cupola. These are gas-fired and equipped with steel mill mixer drives and controls. Metal from the mixers is delivered to the converters by means of 60-ton transfer ladles, having top diameters of 111 in., bottom diameters of 95 in., and being over 98-in. deep. (Three of these ladles are in service at Acme). The ladles charge the converters with about 80 per cent. of hot metal. Scrap is then introduced to cool the charge and various additives are utilized to produce any desired grade and type of carbon or low-alloy steel. Carbon is burned out at about 1,650 deg. C. by means of an oxygen lance, positioned in the converter somewhat above the charge. It takes 30 min. for the converter blow and 60 min. for the entire operating cycle, which produces some 60 net tons of steel. The converter lining lasts about 160 blows.

The daily capacity of the plant is about 1,200 tons of steel and since 2,000 cu. ft. of oxygen is required to convert a ton of metal into steel, a 50-ton heat requires about 100,000 cu. ft. from the company's new oxygen plant, adjacent to the main installation. Metal from the converter is poured into 60-ton teeming ladles featuring special swivel-type bottom tap rigs, seven of these ladles are in use for pouring steel into ingot moulds.

Current facilities at Acme enable the company to produce 37,600 tons of ingots per month, more than 450,000 ingot tons per year.

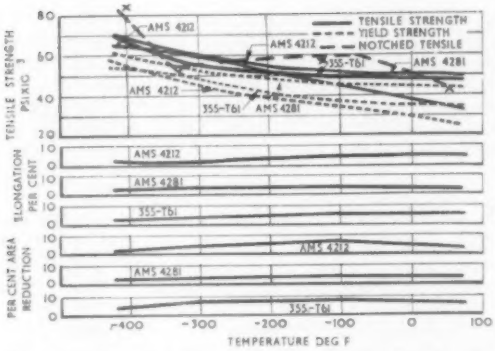


FIG. 5.—*Tensile properties of cast aluminium alloys at low temperatures. Only tensile strength was obtained for the "notched" tensile test.*

Shell-moulded versus Core-moulded Test-bars for Bronze*

By S. Goldspiel, E. W. Chrzan and M. L. Foster

The method of shell-moulding for producing ready-to-test tensile bars is being investigated for G, M and Z bronze-alloy castings to replace current practice. The investigation described in this paper included (*a*) correlation of properties obtained with shell-moulded bars compared with core-moulded; (*b*) relationship between temperature of pouring and tensile properties for both, and (*c*) determination of the effects of pouring temperature, mould material, alloy and pattern type on the equivalency of results. (See Fig. 4.)

The surface finish of tensile bars produced in shell moulds is approximately 60, 80 and 120 microns for G, M and Z alloys respectively. Increasing roughness appears to be related to a corresponding increase in their lead contents. Table 2 shows properties of shell- and core-moulded bars, poured in the range of 1,090 to 1,120 deg. C., under routine foundry control conditions. Table 3 gives the relevant alloy compositions.

TABLE 2.—*Properties of Shell- and Core-moulded Bars poured in the Range of* 1,090 *to* 1,120 *deg. C. Under Routine Foundry Control Conditions.*

Alloy type.	No. o samples.	Tensile strength tons per sq. in.		Per cent. elongation in 2 in.	
		Shell bars.	Core bars.	Shell bars.	Core bars.
Gunmetal "G" ..	29	46.6	46.3	46.2	41.8
Valve bronze "M" ..	36	42.6	43.6	40.1	46.3
Hydraulic bronze "Z"	8	38.8	40.1	29.7	34.6

From Table 2 it will be seen that the tensile strengths for alloy G (gunmetal) produced by both types of moulds are equivalent, but the elongation value is appreciably higher for the shell- rather than the core-moulded tensile bars. In the M bronze alloy (valve bronze) with higher lead content, both the strength and ductility values are significantly higher for the core- than the shell-moulded bars, and this trend is also evident in the high-leaded bronze alloy. It will also be noted that at a relatively-constant pouring temperature of 1,090 to 1,120 deg. C., the tensile properties of the shell-moulded leaded alloys are lower than those of the core-moulded bars.

Pouring temperatures

The effect of pouring temperatures was next investigated. For each of the three tin-bronze alloys, three tensile bars were poured in each type of mould at seven pouring temperatures ranging from 1,440 to 1,200 at 20 deg. increments. For all three alloys, the tensile strength for both types of bars increased 20 to 30 per cent. as the pouring temperature decreased from 1,177 to 1,066 deg. C.

Elongation

In general, shell-moulded values for G alloy increased from 1,040 deg. C., whilst others decreased for temperatures up to 1,200 deg. C. Core bar values decreased 30 to 40 per cent. Macro specimens from longitudinal centre sections of whole bars were used to study the grain size and solidification characteristics.

G alloy

Macrostructures for G alloy showed that the grain-size became generally smaller with decreasing pouring-temperature, for both shell- and core-moulded bars. The grain (homogeneity) became more uniform throughout the section as the temperature of pouring was lowered. The effect of both grain refinement and distribution conditions in the case of G alloy was to produce a general increase in the tensile strength with decrease in pouring temperature. As far as elongation was concerned, the two grain conditions might lead to a high or low elongation depending upon which condition predominated.

M alloy

As with G alloy, M alloy showed a decrease in grain size with decreasing pouring temperature for both shell- and core-moulded bars. Tensile strength increased because of the general grain refinement and higher elongation accompanied equiaxed grains and coarser grain structures.

Z alloy

The macrostructure for alloy Z for the six temperatures of pouring did not yield any clear-cut relationship to the observed tensile and elongation values. An explanation of the comparative properties between shell and core bars for alloy Z was sought in a study of the microstructure. Microstructure is influenced by two factors (*a*) grain size and shape and regularity (dendritic configuration) and (*b*) porosity. In the case of shell-moulded bars for the Z alloy, two factors (porosity and microstructure) interacted to influence the mechanical properties. It appeared that the best combination of the two existed at a pouring tem-

* Abstract of paper presented at the Annual Congress of the American Foundrymen's Society last year and printed in full in *Modern Castings*. The Authors are employed in the materials laboratory, New York Naval Shipyard, Brooklyn.

American Foundry Technology

TABLE 3.—*Composition Specifications of Bronzes used for Test-bars.*

Alloy type.	Cu per cent.		Sn per cent.		Zn per cent.		Pb per cent.		Ni per cent. Max.	Fe per cent. Max.	P per cent. Max.
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.			
G	89.0	86.0	9.0	7.5	5.0	3.0	0.30	—	1.0	0.15	0.05
M	89.0	86.0	6.5	5.5	5.0	3.0	2.0	1.0	1.0	0.25	0.05
Z	86.0	84.0	6.0	4.0	6.0	4.0	6.0	4.0	1.0	As specified.	0.05

perature of about 1,095 deg. C. The core bars in Z alloy showed more random orientation as the temperature was decreased, probably as a result of the higher lead content.

Conclusions

Values obtained from both types of bar under routine foundry control conditions compare favourably with bars made under experimentally controlled conditions. At the optimum temperature of 1,095 ± 12 deg. C. tensile values are essentially equivalent, although the elongations differ. Core bars do better in the leaded alloys. The shell-moulded bar used in this investigation develops properties significantly above specification requirements, and is sufficiently discriminating for all types of alloy.

Low-temperature Properties of Cast Aluminium*

By J. H. Belton, L. L. Godby and B. L. Taft

Low-temperature tensile properties and average-coefficients of linear expansion from low to ambient temperature were obtained for materials applicable to rocket engines, including aluminium, nickel, iron, copper and titanium-base alloys and plastics. However, cast aluminium was the only foundry alloy tested (see Table 4).

TABLE 4.—*Materials Tested in Low-temperature Service.*

Material and form.	Specification.	Trade designation.	Heat treatment.	Nominal composition, per cent.
Aluminium alloy: Sand cast ..	AMS 4212	355	T6*	1.2 0.5 .. 5.0
Gravity-die-cast	AMS 4281	355	T6*	1.2 0.5 .. 5.0
Gravity-die-cast	—	355	T61†	1.2 0.5 .. 5.0

* T6 = Soln. H.T. and artificial ageing. Typical 510 deg. C., 12 hr., water quench age 3 to 5 hr. at 175 deg. C.
† T61 = Soln. treated as above, but aged 8 to 10 hr. at 175 deg C.

Three types of specimens included two tensile (of 0.250 in. dia.) one of them notched with a 60 deg. "V" notch, 0.037-in. deep, 0.005-in. radius at root, and one dilatometric specimen approximately 5-in. long by 0.325-in. dia. The tensile properties of cast aluminium alloys are shown in Fig. 5.

* Abstract of paper presented at the 63rd annual meeting of the American Society for Testing Materials. The Authors are attached to the Florida research and development centre, Pratt & Whitney Aircraft.

Alloys tested which are considered suitable for use with liquid hydrogen are wrought and cast aluminium, nickel, copper, and 9310 and A-286 steel. Although type 347 (Cr 18 and Ni 8 per cent.) stainless steel was not tensile tested for this report, it has been the mainstay of rocket-engine parts because of its known good properties at very low temperatures, its formability, welding and brazing qualities and its moderate heat- and corrosion-resistance. It is used for chamber tubes and reinforcing bands, injectors and piping. Cast aluminium alloys are used for pump housings and gearboxes, and wrought aluminium alloys for turbine and pump rotors and engine mounts. Gears

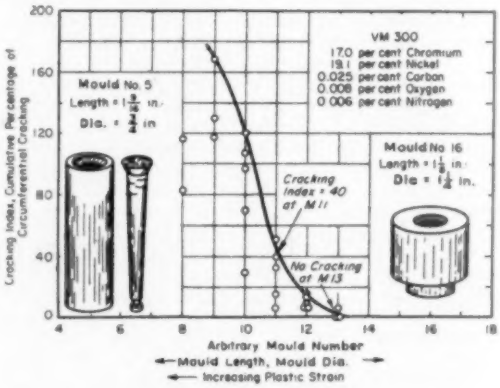

VM 300
17.0 per cent Chromium
19.1 per cent Nickel
0.025 per cent Carbon
0.008 per cent Oxygen
0.006 per cent Nitrogen
Mould No. 5
Length = 1 3/16 in.
Dia. = 3/4 in
Mould No 16
Length = 1 1/8 in.
Dia = 1 1/4 in.
Cracking Index = 40 at M11
No Cracking at M13
Cracking Index, Cumulative Percentage of Circumferential Cracking
Arbitrary Mould Number
Mould Length, Mould Dia.
Increasing Plastic Strain

FIG. 6.—*Cast-pin tear-test curve for a stainless steel of a specific composition. Note the shape of pin (illustrated on the graph) designed to induce the contraction strains on which the effects of the test depend.*

are made from 9310 steel carburized and A-286 steel is used for bolting. Expansion and contraction bellows are made of Inconel X and copper-beryllium.

Automatic Production of Shell-moulded Engine Valves*

By R. H. Herrmann

The casting of high-nickel high-chromium steel exhaust-port valves in shell moulds is a highly-automatic operation at Ford Motor Company's foundry

* Abstract of paper appearing in the April issue of the American journal, *Foundry*.

at Dearborn. Valves are produced at the rate of 9,600 an hour in a number of sizes for all the Ford engines. De-finning the ingate core, unloading coremaking and moulding machines, mould assembly and pouring are the only operations involving hand labour, all other operations, such as mould making, production of the ingate core, pouring cup, shakeout, etc., being automatic.

Resin-bonded sand moulds and pouring cups are made on a 15-station machine, with a continuously-rotating dump-box. A 12-station ingate coremaking machine operates in a similar manner to that of the mould-making machine, one difference being, however, that no dump-boxes are used. The mould-making machine completes a cycle in about 80 sec., whilst the coremaking unit takes approximately 70 sec.

Sand Preparation

The coated sand used in both the mould-making and coremaking machines is prepared as follows: 500 lb. of sand of AFS 110 grain classification is heated to 170 deg. C. in a rotary gas-fired kiln and discharged into a mixer where 23 lb. of flake resin is added and the mixture mulled for three minutes. The resin-coated sand is next dumped into a skip bucket and then into a second muller where 3½ lb. of hexamethylene-tetramine mixed with 1 gall. water is added. After the lumps in the mixture have been broken down, 10 oz. of powdered wax is added and the mixture is given a final mulling. The coated sand is then screened and conveyed to a hopper situated over each of the rotary mould-making machines. A different sand mix is prepared for the runner cores, consisting of 250 lb. sharp sand, 3 lb. powdered phenolic resin and 2 lb. cereal. After being mulled for 1½ min., 6 pt. of water are added, followed by mulling for a further minute. Then one pint of release-agent (one part sand conditioner and two parts kerosene) is added and the mixture is mulled for 30 sec. before being discharged to a bucket elevator for delivery to a hopper situated over the two coreblowing machines.

Mould Assembly

Workmen at a bench alongside the conveyors take an ingate core off a monorail carrier, punch a hole in the top of the sprue with a rod, and place the ingate core on a valve mould also taken off the monorail carrier. This assembly is then placed on a runner core on the car conveyor, and a man then slips a pouring cup over the end of the sprue. The mould conveyor moves under an automatic flask setter which lowers a steel flask on to each car as the conveyor moves through, each flask surrounding a group of five moulds. Flasks are filled with shot at the next station and a funnel device is set on the flask by an air cylinder and "rides" with the flask for a short distance. The device has an inverted V channel in the centre which covers the pouring cups on the five moulds in the flask. Shot from an overhead hopper and vibrating feeder spills down a two-channel chute which directs the shot to each side of the sprue cover to pack the moulds. When the flow of shot ceases, the funnel device is lifted and shuttled back to the succeeding flask. The conveyor then continues around to the pouring hood where two men pour high-nickel/chromium alloy steel at a temperature of 1,630 deg. C. from hand-operated monorail-suspended ladles. The alloy is melted in two 6-ton, top-charged, swing-roof, electric-arc furnaces. Melts are tapped into 1,500-lb. ladles moved by monorail carrier to either of two smaller arc-furnaces having holding capacities of 5,500 lb. From these holding units metal is tapped at 1,638 to 1,643 deg. C. into pouring ladles so that it will enter the moulds at not lower than 1,630 deg. C. The alloy composition employed is given as Cr 15 to 16 per cent., Ni 13 to 16 per cent., Si 2.5 to 3.5 per cent., C 0.85 to 1.05 per cent., Mn 0.3 to 0.6, balance Fe.

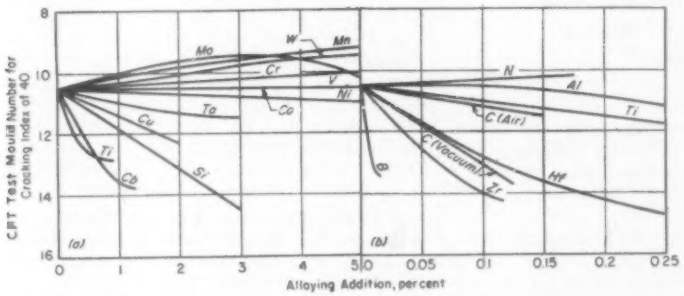


FIG. 7.—*Correlation of test-pin shape (represented by mould number) with alloy additions to achieve the arbitrary test-mould number of 40 for hot cracking in a 16/20 chromium/nickel stainless steel. The two parts of the graph (a) and (b) cover higher and lower ranges of addition respectively.*

Shakeout

Poured moulds travel through a cooling-tunnel for a period of 15 min., and when they emerge, a pneumatic ram pushes flasks off the cars onto a vibrating perforated plate. Shot and sand fall through, the flask is lifted and moved automatically to the flask-setting device for re-use, and the cast clusters, each of 16 valves, move off the end of the plate in an upright position. The chain conveyor is 1,152-ft. long and carries the cast assemblies at ceiling level, providing a cooling time of 51 minutes. The cast assemblies are next taken down to a mezzanine floor where they are carried through channels to hold them straight whilst two spinning wheels with hinged weights knock off the valves to

American Foundry Technology

fall on to an inclined belt-conveyor. From here, the cast valves are taken to a rotary, continuous-flow, blast-cleaning machine. Thence, the cleaned valves are dumped on to an automatic sorting machine which can cater for 9,800 valves per hour.

Quality Control

Metal samples for chemical analysis are taken from the large furnaces immediately after melt down, and after the metal is transferred to the smaller furnaces, chemical tests are run-off every half-hour. Three 16-valve clusters, one poured from the first, middle and last metal of every small furnace melt, are taken from the production line for testing. At the laboratory, one valve from each cluster is cut in half lengthwise, one half being etched and examined visually for microshrinkage; the other valves are X-rayed and if a valve fails either inspection, the entire production from the melt is scrapped. In addition, dimensional and warpage checks are made on valves taken from production every hour.

Effects of Alloying additions on Hot Cracking of Austenitic Chromium/Nickel Stainless Steels*

By Frederick C. Hull

This paper is concerned exclusively with the effects of alloying elements on cracking during solidification, such as the hot cracking of "as-deposited" weld metal and the hot-tearing of castings in the foundry (see Figs. 6 and 7).

The cast-pin tear (CPT) test (Fig. 7) is a rapid and inexpensive test that produces cracks in chill-cast pins as they freeze and cool under conditions intended to simulate the restraint imposed during welding of heavy sections. By using this test, it was possible in a period of one year to evaluate quantitatively the effects of 18 alloying elements on the hot-cracking tendencies of chromium/nickel stainless steels.

General Principles

The CPT test for susceptibility to hot cracking is carried out by levitation melting 19-gm. samples of an alloy in an argon atmosphere and casting the melts as about ¼-in. dia. tapered pins in a series of copper moulds. Restraints at the ends of the pin impose a tensile strain on the sample as a result of the thermal contraction of the casting and the thermal expansion of the mould. The top and bottom of the pin lock in place to prevent normal contraction of the metal. Therefore, tensile stresses are set up in the pin as it cools and shrinks inside the mould. These stresses tend to cause the metal to tear apart; the longer and slimmer the pin, the greater the tearing. By comparing pins of different lengths and diameters, a scale is built up to describe numerically the susceptibility to hot cracking. The scale is then used for evaluating this characteristic in alloys of different compositions. The lengths of the moulds vary from 1¼ to 2¾ in. and their outside diameters from ¾ to 1¼ in.

Results

In the typical CPT-test curve illustrated in Fig. 6, the long slender moulds (which have the smaller assigned numbers) produce severe cracking, whereas the short, heavy-walled moulds (which have the larger numbers) crack the pin less severely or not at all.

The cumulative percentage of circumferential cracking (cracking index) was determined and was then plotted against arbitrary mould-numbers to provide a measure of the susceptibility of the alloy to hot cracking. Two arbitrary points (the mould numbers for cracking indices of 0 and 40) were taken from the CPT test curve as representing the susceptibility of the alloy to hot cracking.

A study of the effects of various types of alloying elements were carried out on the base elements (chromium 10 to 20 per cent., nickel 10 to 20 per cent., and also cobalt); interstitial elements (carbon and nitrogen); deoxidizers (manganese, silicon and aluminium); solid-solution hardeners (copper, vanadium, molybdenum and tungsten); and carbide stabilizers (titanium, columbium and tantalum), and three other strong carbide- and nitride-forming elements (boron, zirconium and hafnium).

In order to be able to compare the effects of air and vacuum melting, four different techniques were employed in the preparation of alloys. The results of all these tests have been summarized in two curves. The beneficial additions moving toward lower mould-numbers are easily distinguished from the detrimental ones. Moreover, it is fairly clear what composition limits should be specified for each element to achieve maximum resistance to hot cracking. Figure 7(*a*) includes those elements added in amounts ranging from about 0.5 to 5 per cent., whereas Fig. 7(*b*) covers the range from about 0.01 to 0.25 per cent.

Conclusions

The effects of 18 alloying elements on susceptibility to hot cracking rank in the following order (starting with the most beneficial and ending with the most detrimental): N, Mo, Mn, W, Cr, Co, V, Al, Ni, Ta, Cu, Si, Cb, Ti, C, Hf, Zr, and B.

Grain boundary fractures that were produced at the surface of CPT test pins appeared to be caused by hot cracking in the temperature range just below the solidus, although in alloys containing B, Cb, Hf, and Zr cracking could have occurred while there was still liquid present within the pin. These data may be used to design alloys with improved resistance to hot cracking.

* Paper presented to the American Society for Testing Materials. The Author is advisory metallurgist, Westinghouse Research Laboratories, Pittsburgh, Pa. In UK foundries, the term "hot-tearing" is often used instead of "hot-cracking." —EDITOR.

Inoculants for Grey Iron*

By D. D. McGrady, C. L. Langenberg, D. J. Harvey and H. L. Womochel

In this paper, data are presented on the effect of silicon, graphite, aluminium and calcium additions on the solidification, microstructure and mechanical properties of grey iron. When making comparisons between irons, an effort was made to keep the carbon equivalents $C + \frac{Si}{3}$, within 0.1 per cent of one per cent. for a TC.2.80, Si. 2.50 per cent. composition. Melts were brought to 1,565 to 1,595 deg. C. as indicated by an optical pyrometer. The molten iron was transferred to a pouring ladle and the additions made during the transfer or in the ladle. Pouring temperatures were 1,450 to 1,470 deg. C. as indicated by the optical pyrometer or, in some cases, an immersion thermocouple.

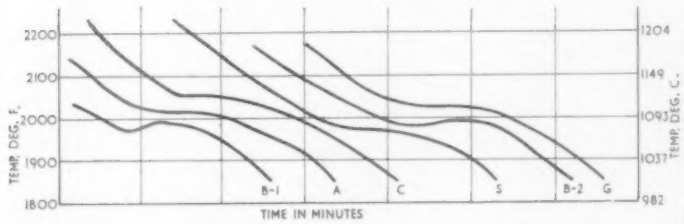


FIG. 8.—*Comparison of typical cooling curves from cylindrical cast-iron specimens. B-1, not inoculated, "blank" melt; B-2, blank melt, second series, not inoculated; A, inoculated with 0.6 per cent. aluminium; C, inoculated with 1 per cent. calcium; G, inoculated with 0.5 per cent. fine graphite, and S, inoculated with 0.55 per cent. silicon.*

As the work continued, it became evident that the transverse breaking load, the deflection, and in particular triangular resilience provided a more sensitive index of variation in microstructure and the effectiveness of inoculants than did the tensile strength. When the microstructures were examined, it was concluded that the results of the transverse test were closely correlated with variations in microstructure. Three irons were treated with purified silicon (99.8 per cent. Si, balance Fe) for comparison with untreated melts and data on the mechanical properties of these irons indicated that an addition of silicon to a hypoeutectoid iron is without effect on these properties.† One iron was treated with an iron/silicon alloy, designated as a "low aluminium ferro-silicon" (Si 93.0, Al 0.45, Ca 0.01 per cent. and balance Fe). This alloy is not recommended as a commercial inoculant as comparison of this iron with the corresponding "blank" showed that late silicon in this form had a negligible effect on properties. Two further irons were melted to determine the effect of silicon additions made as a silico-manganese alloy. The alloy contained Mn 65.50, Si 18.5, C 1.25, Ti 0.17 per cent., balance Fe (Ca and Al present only as traces). Comparison of these irons showed that the late addition of silicon as silico-manganese was also without benefit.

* Abstracted from a paper presented to the American Foundrymen's Society. Of the Authors, Mr. McGrady is assistant professor and Mr. Womochel is professor of metallurgical engineering at Michigan State University, East Lansing; Mr. Langenberg is supervisor metallurgist Oldsmobile division and Mr. Harvey is research metallurgist, General Motors Corporation laboratories.

† Low-carbon irons were selected for this investigation because of their strong tendency to produce types-D and -E graphite and because of their sensitivity to the inoculating additions.

Additions

Calcium

Data for pure calcium and for a calcium/silicon alloy containing 31.72 per cent. showed that calcium and calcium/silicon were the most effective inoculants employed in the research described. In the experiments carried out, the metallic calcium additions were made by plunging the active metal on an iron rod. It was observed that calcium was effective in decarburizing the melts. For example, an addition of 1.00 per cent. of calcium to an iron of approximately 3.00 per cent. of carbon reduced the carbon content of the iron by 0.24 per cent. A tendency for calcium additions to effect a small reduction in the sulphur content was also observed, this reduction amounting to approximately 0.01 per cent. in most cases.

Aluminium

Data obtained for the effect of aluminium additions indicated that those of the range investigated were ineffective in improving mechanical properties. Large additions of aluminium produced a marked reduction in chilling tendency and it was also apparent that a reduction of chilling tendency could be produced without the alteration of the graphite structure to type-A, from the abnormal structure of the untreated irons.

Graphite

During these experiments, a commercial grade of graphite especially prepared for ladle additions was used—of 20 mesh and below. The graphite was added to the ladle during tapping. Not all this graphite dissolved prior to pouring and the iron was poured from below the excess graphite. The data showed that graphite additions were effective in improving mechanical properties and reducing chill. Examination of the microstructures of treated and untreated irons showed a marked improvement of graphite distribution resulting from the addition.

American Foundry Technology

Other Results

Influence of additions on the eutectic temperature had been studied in the past by several investigators and the work of Mr. J. T. Eash has received particular attention. Eash poured inoculated and uninoculated irons ranging from 1.74 to 2.37 per cent. C into castings of 3-in. section and showed an elevation of the eutectic temperature by the ladle treatment ranging from 20 to 40 deg. C. He also quenched castings of 1.2-in. section from 10 deg. C. below the eutectic temperature and found the iron to be entirely white and free from graphite. Since the untreated irons were grey with type-D graphite when cooled normally to room temperature, it was concluded that untreated iron solidified as white iron, and that type-D graphite then formed from decomposition of cementite in the solid state. The idea that inoculation involved a nucleation accompanied by an elevation of the eutectic temperature has since been generally accepted.

Experiments were undertaken in the research described in this paper to determine the effect of silicon, calcium, aluminium, and carbon in the form of graphite on the temperature of eutectic freezing. Fig. 8 shows that the curves for B-1 and B-2 which are untreated irons show an undercooling dip. The elevation of temperature resulting from the addition of pure calcium was large and for the three determinations carried out the increases were 48, 40 and 42 deg. C., respectively. Four curves were plotted for when graphite was added, these showing elevations of 29, 44, 33 and 30 deg. C. Determinations made for silicon additions exhibited elevations of 3 and 5 deg. C. The amount of elevation produced by silicon additions in the experiments carried out was a small fraction of that produced by the effective inoculants, calcium and graphite, and might be regarded as within the limit of experimental error. Two determinations were made for additions of aluminium, the amount being added was 0.60 per cent. in both cases. The increase in eutectic temperature was 40 deg. C. for the first curve and 25 deg. C. for the second. This effectiveness of aluminium was surprising in view of the fact that aluminium additions produced no improvement of mechanical properties and only a small and uncertain effect on microstructure. The peculiar behaviour of aluminium which elevates the eutectic temperature without producing an improvement of properties and without producing type-A graphite near the surface of the casting was noted.

Conclusions

Specific conclusions and observations from this report are that the various grades of ferro-silicon increased in their inoculating power with increasing content of calcium and aluminium; that a grade of ferro-silicon, low in active-metal content, was without value as an inoculant; that an alloy of silicon and manganese which contained only traces of calcium was ineffective; that additions of purified silicon (99.8 per cent. Si, balance Fe) were ineffective; that as little as 0.10 per cent. of metallic calcium was powerful in improving properties and microstructure; that larger additions of metallic calcium increased decarburization (indicating the formation of an insoluble carbide of calcium); that the most effective inoculating alloy was calcium/silicon alloy containing approximately 30 per cent. silicon, and that additions of 0.07 and 0.5 per cent. aluminium were ineffective in improving graphite distribution, but were effective in reducing chill.

News from India

Hindustan Machine Tools, Limited

The State-owned Hindustan Machine Tools, Limited, at Bangalore, has made a net profit of Rs. 7,402,249 during 1960-61, a two-fold increase over the previous year. The annual report of the company for 1960-61, states that the profits for the year represented a return of 13.9 per cent. on the share capital against earlier returns of 1.02 per cent. for 1956-57, 5.54 per cent. for 1957-58, 7.15 per cent. for 1958-59 and 8.22 per cent. for the subsequent year.

The production of 1,002 machines during 1960-61 represented, the report says, an increase of 250 per cent. over the plan target of 400 machines and compared with 702 machines during the previous year. During the year, the factory booked orders for 1,005 machines. Together with the orders brought forward on April 1, 1961, of 513 machines, the factory had 1,518 orders for execution. Against that, 1,007 machines had been despatched leaving orders for 511 machines to be carried forward to the following year.

The duplicate unit of the factory was to be commissioned by the end of last month. The completion of the unit in a record time of 14 months is entirely out of the factory's internal resources. A dividend of 10 per cent. has also been declared.

Manufacture of Tanks

The Government of India is expected to establish shortly a major plant at Avadi to manufacture tanks with foreign technical and financial assistance. The Defence Ministry of India, through an official team, has discussed terms of collaboration with Vickers Armstrongs, Limited, the British firm specializing in the manufacture of tanks and aircraft, and negotiations in the same connection have also been held with a West German firm of tank manufacturers. It is stated that a final decision on the choice of foreign collaboration will be taken after the Government of India has made an assessment of the terms offered by the German and British firms. According to indications, the chances of an agreement being signed with Vickers Armstrongs are considered to be bright.

The proposed tank manufacture plant will be one of the major enterprises the Defence Ministry will take up during the third five-year plan.

Machine Tool Institute

The necessary equipment and technical assistance for the establishment of the Central Machine Tool Institute of India, which is to be located at Bangalore, has been offered as a gift to India by the Czechoslovakian Government. The functions of the Institute will be design development of machine-tools, standardization, manufacture of prototypes, training of designers and design personnel, machine-tool research and metal cutting.

Bulgarian Foundry Industry

Survey of Rationalization and Rehabilitation Proposals

Whilst small countries with little industry face considerable problems in their efforts to catch up with their more-advanced neighbours, they possess one undoubted advantage in that they are able to benefit by the experience of others and avoid some of their mistakes. They are able to study the "wood" before they start "making their patterns." In this glance at the rebuilding of Bulgarian foundry industry the Authors discuss a problem which is of interest to foundrymen everywhere—what in general is the optimum size of the casting-producing unit and what are the merits and drawbacks of being "tied," or "separate"?

A report on the planned rationalization of the Bulgarian foundry industry is contained in a paper entitled "Trends in the Development and Specialization of Foundry Production in Bulgaria," by Ivan Petrov and Eng. Vladimir Dimitrov (of the Electrometal Steel Foundry, Sofia) and published in the Bulgarian journal *Mashinostroene*. In their preliminary remarks, the Authors state that modern machines require for their manufacture 40 to 60 per cent. of metal in the form of castings, and hence the foundry industry is the backbone of mechanical engineering. As a result of this, the correct development of the Bulgarian mechanical-engineering industry and its economy call for serious consideration of the development of foundries, their size, form and equipment. For this reason, the Authors feel that it is necessary to analyse both the development of foundry production and the organization of foundries in various countries and thereby determine the methods most expedient for application to the domestic industry.

General Studies

The report continues by stating that in countries with advanced mechanical engineering, castings production is centred mainly in large foundries, the only exception being the large combines which have their own foundries. A characteristic feature of the countries studied is that a large number of machine-tool plants are served by a small number of specialized foundries, and according to data obtained from the USA, 120 plants making internal-combustion engines are served by 18 foundries, and 230 motor and generator plants, by 14 foundries. The relative weight of the total output of castings in specialized foundries is 57.7 per cent. devoted to cast iron, 76 per cent. steel, and 71.1 per cent. malleable iron.

Considering Russia first, the Stankolit foundry concern in Moscow is built especially for the manufacture of castings for machine-tools and supplies a number of plants throughout the country with these, including those situated at a great distance, for instance Kiev and Cheliabinsk (over 40 such plants are thus served). Two trends are discerned in the development of foundry production—to build foundries at the metal-processing plants (mainly as carried out in Germany), and to build separate specialized foundries with a considerable volume of output (used chiefly in the USA and USSR). The lines along which foundry production has been developed in the most economically-advanced countries is by the setting up of large-scale specialized production. This, the authors feel, should be borne in mind in the development of the Bulgarian foundry industry as the compliance of this principle and the utilization of modern techniques of production will ensure production at lowest cost. Conversely, it is felt that dispersion of foundry production in a large number of small enterprises will deprive the country of the possibility of using modern techniques and will lead inevitably to higher costs of production.

Bulgaria's Needs

In connection with the rapid increase in Bulgaria in the requirements of cast iron, steel and non-ferrous castings up to 1965, a series of questions arises, both in relation to the merging of existing foundries and the building of new ones. These questions are (*a*) what capacity should the new foundries have; (*b*) how can the existing foundries be merged; (*c*) should the foundries be specialized or not, and what place has foundry production in the whole scheme?

Dealing first with specialization, the Authors feel that foundries in Bulgaria should not be divided into districts because they believe that distribution of certain types of castings over several foundries will prove harmful, since this will decrease their quantity production. In turn, the dissemination of production of repetition castings will not allow the introduction of mechanized production lines and this will lead to a more expensive method of production. It should not be ignored that production of repetition castings in Bulgaria at present is very small. Specialization is imperative also because of the high cost of pattern equipment for machine moulding. If the work be undertaken by foundries in various districts, it would lead to unnecessary expense on moulding equipment in order to turn out the same quantity of castings.

Dealing next with the question of the merging of foundries, the Authors state that in order to meet the large requirements of castings for 1961

to 1963, a major role will have to be played by existing foundries, wherein the conditions of working must be improved. At the same time, as not all these foundries are working to full capacity, it is envisaged that their load should be increased. After 1963, a large proportion of the castings required will be manufactured by established foundries and they should now begin to prepare, reorganize and mechanize, with a view to meeting the new requirements. With the introduction of mechanization, the Authors feel that a number of foundries will increase their volume of production considerably and in this way will be able to take over the work of some foundries at present operating at high cost and this, in turn, will lead to a certain amount of merging. Larger-scale mergers may be effected only after the new foundries are put into operation. Then, and only then, foundries with poor hygienic conditions should be discarded, as well as those where there are no prospects for extension, partial or full mechanization.

Ideal Size?

What should the capacity of the new foundries be? In this respect, the experience of the Sulzer concern in Switzerland is of interest, as the firm has built a large plant for producing castings ranging from 2 cwt. to 120 tons in weight, whilst castings weighing less than 2 cwt. are manufactured in another plant. The Authors feel that for the new foundries which are to be built, larger capacities should be envisaged in the final stage of planning, while the construction work should be carried out in stages. In this way, the problem of training and specialization of personnel will find a much easier solution. This means that stages of expansion should be envisaged in the initial scheme and the knowledge of what castings are to be produced will be of major importance in this respect.

At present, there is in Bulgaria a diversity of opinion as to whether 5,000 or 15,000 tons of castings annually will be required. If one assumes, therefore, that a certain plant (operating with moulding machines, etc.) manufactures castings with an average weight of 22 lb., then two pairs of machines will turn out moulds for about 6,000 tons of castings annually. However, it is interesting to know what kind of modern plant it is which can operate with four moulding machines only! The statement about the 15,000 tons capacity is likewise nebulous. For example, for small castings up to 7 lb. in weight, an annual capacity of 15,000 tons would be rather large, but for castings weighing 2 cwt. or thereabouts, it would be too small.

Factual Considerations

The study the Authors have carried out in their own foundry at Sofia, which at present produces 10,000 to 11,000 tons of castings annually and under local conditions of work is, in fact, a fairly well-specialized plant, shows that in order to enable the plant with a new capital construction to preserve the existing cost level of steel castings, the shop should have a minimum capacity of 25,000 tons annually. Considerable capital expenditure should be made in new foundries for the purpose of mechanization, alleviation of labour, for better hygiene, control laboratories, etc. The Authors state that their company's castings are still expensive and do not always meet modern technical requirements, but there are possibilities of lowering their cost and of improving their quality. For instance, their foundry increased the aggregate numbers produced from 35,000 in 1953 to 550,000 in 1959. By this increase in the demand, production costs had been lowered and it should be emphasized that the cut in expense was derived solely from the increase in demand and in technological advances, without resort to complex mechanization. This latter step forward it was expected, in turn, would offer another possibility of a further and larger reduction in costs. It therefore became evident that foundries might develop profitably and competitively only by making use of modern techniques and utilizing to capacity plants with a large volume of production.

"Tied" *versus* "Separate"

By considering the foundry industry in other countries, it is obvious that the most advantageous place for a foundry is not as an appendage to metal-processing plants, but as independent units. In addition to rationalization of production, which is a prerequisite for full mechanization, the creation of a foundry serving a number of other plants has a number of advantages. Specialization in certain castings leads to a sharp decline in scrap, and the attention of the management is centred only on foundry production—unlike the cases where the foundry is a constituent part of the whole plant—and hence, problems of production are solved with greater ease and thoroughness.

The basic advantage of centering production in a specialized foundry of large capacity, however, consists in the effectiveness of the utilization of available funds. Thus, certain authorities in Bulgaria suggest the building of five new steel foundries with a capacity of 15,000 tons annually and ten iron foundries with a capacity of only 9,000 tons annually. In order to achieve economical productivity, all these would need to have modern equipment—laboratories, furnaces and power sources, sand-preparation plant, etc. The 15 foundries—even for the suggested small capacity—would need to be equipped each with laboratories, processing equipment, sand-preparation plants, etc. However, it is well known that the output of this type of equipment with larger capacity is considerably cheaper because of the relatively smaller operating costs and comparatively smaller share of amortization deductions per ton of castings produced.

Therefore, if Bulgaria wishes to have a profitable foundry industry, the Authors contend that no more than three foundries should be envisaged, instead of the proposed 15. Only large specialized foundries permit the extensive introduction of modern techniques and ensure steady technical progress, they conclude.

*Craft Apprentices' Corner**

Positioning and Supporting Cores in Moulds. . .

. . . with " Tubal Cain " on the Job !

A few days ago I'm stood watchin' a young feller placin' a core in a mould, an' whilst I'm watchin' I'm thinkin' to meself " That's goin' to crush." Well, after a bit o' wangling 'e got the core in an' 'e seemed quite satisfied. I walked over to 'im an' says, quite pleasant like, " 'Avin' a bit o' trouble son?" " No sir," 'e answers, " core's a bit tight, that's all." " I can see it is," I says, " an' I can also see it's crushed the prints." Well, at this 'e was quite surprised, 'cos bein' underneath the core 'e 'adn't noticed the crush. " Don't look so surprised son," I says, " with a tight-fitting core like that one is you can *expect* it to crush, an' particularly so because you haven't eased the core-print." " Ain't never been told about that sir," 'e says, " perhaps you can give me the low down?" " That's just what I'm goin' to do," I replied, and went on to explain to him how the business of positioning cores in moulds is one which requires quite a bit of skill and forethought—if the job's to be done properly, that is.

Where the Trouble Arises

It should be fully realized that a core is an independent item, and can therefore be moved about at will. It should also be obvious that there is only one *correct* position for the core, hence

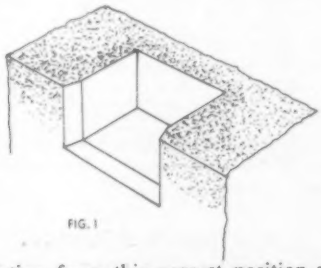


FIG. 1

any deviation from this correct position will only result in dimensional inaccuracy. For the correct positioning of cores we rely to a large extent on the core-prints provided, but even so there are still right and wrong ways of utilizing the core-prints. Present-day patternmaking practice has reached a very-high standard, and pattern equipment for production-type castings is extremely accurate, thus the correct positioning of cores in such cases gives little trouble. With loose-pattern moulding however, this is not always the case. In loose-pattern moulding one of the most important points in the operation of core-laying is to avoid

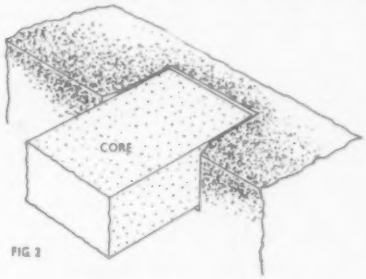


FIG. 2

crushing the core-prints, a task which is much more difficult than may at first sight appear to be.

Avoid Crushing . . .

It is worth remembering that several factors can give rise to crushing, but basically the simple reason is that the core is a tight fit in the core-print. All too often the suggested remedy is to rub-down

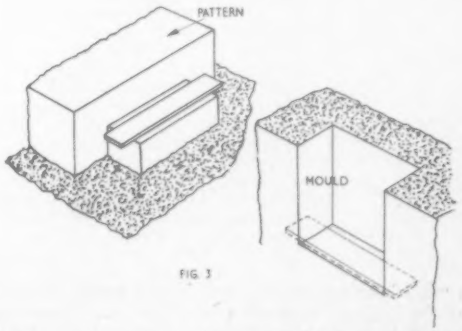


FIG. 3

the *core* to fit the print, and although there are times when this is unavoidable and must therefore be done, it is technically wrong. The core-print of the *mould* should be enlarged a little, sufficient to accommodate the core, but as this is obviously not practicable in all cases, we resort to rubbing-down the core.

F

* Popular jargon of the foundry floor has been used in parts of this article—apologies are made to translators.

Positioning Cores in Moulds

. . . by "easing" Prints

However, the incidence of crushing can be (indeed, should *always* be) minimized by the simple expedient of "easing" the front end of the core-print. This consists simply of cutting a "feather" of sand away from the front edge of the core-print; an exaggerated example would be as shown in Fig. 1. When the core is placed in the print it will seat itself comfortably in the rear part of the print, but will not exert any pressure upon the forward end, indeed, the core will not even be in contact with the print at this point (Fig. 2).

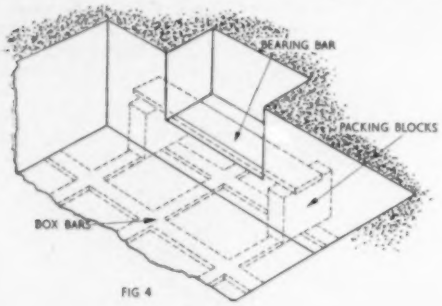


FIG 4

Big 'uns need Support

The next step is to consider larger, heavier cores. Such cores must be supported in their core-prints, otherwise the weight of the core alone will crush the mould. Support to the cores is usually given by incorporating iron or steel bars in the mould during ramming-up. The bar should have

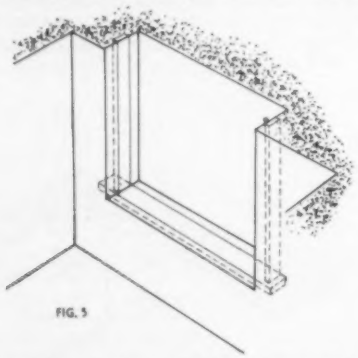


FIG. 5

a wide bearing surface, and is laid across the print of the pattern in such a way that the front edge stands back a short distance from the front edge of the core-print, as in Fig. 3. Now if, after withdrawing the pattern, the front end of the core-print is eased as previously outlined, the result will be that the core will rest on the flat surface of the iron bar, and will not even be in contact with the sand of the mould. The object of the metal bar is really not so much that of strength, but rather that of providing a hard, flat bearing surface which will support the weight of the core. Hence one will see from this that the type of bar (in terms of size) will vary with the size and weight of the core to be supported. They may be anything from 1-in. wide by $\frac{3}{16}$-in. thick to 3 or 4-in.

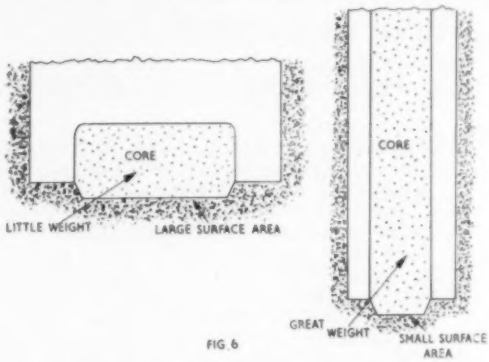


FIG. 6

wide by $\frac{5}{8}$ or $\frac{3}{4}$-in. thick. Again, the sand of the mould is not sufficiently strong to support the really-heavy cores, so the bearing bars are further supported by hard packing material such as fire-bricks or iron blocks which are built in during ramming operations, in such a way as to rest on the bottom grid or plate of the drag moulding box—see Fig. 4. For a deep core-print it is also advisable to incorporate an iron strip at each side of the core-print (Fig. 5). These strips, in addition to strengthening the mould, will also act as guides when positioning the core, and thus prevent possible damage to the mould.

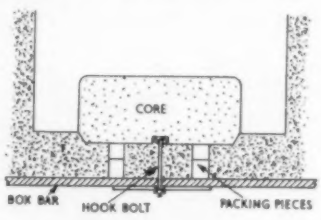


FIG. 7

It's a Question of Shape . . .

Exactly the same rules apply when a core is standing in the drag, although one freely admits that a little more latitude is permissible here. In brief, the greater the surface area of the core-print (in relation to the weight of the core) the less will be the support required (Fig. 6). In many such cases, however, the core is held down in the mould by means of hook-belts, and when this is so it is certainly a very wise precaution to pack the core against the box bars (Fig. 7) and thus prevent the core-print from collapsing when the hook-belt is tightened-up.

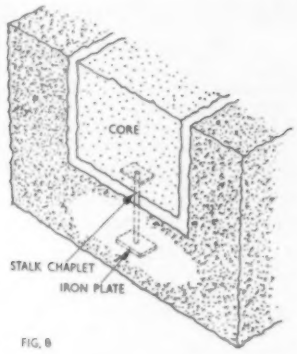


FIG. 8

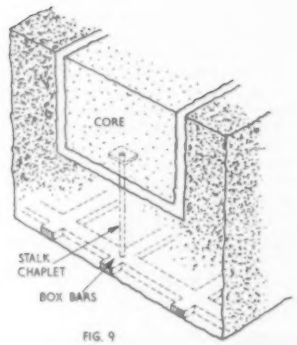


FIG. 9

Enough Support

Very often too, it is necessary to provide support where core core-prints are not available. In these cases use is made of various types of stud and chaplet. Here again the important thing is to provide a sufficient bearing surface, for instance, if an ordinary single stud were used to support a core in a greensand mould, the odds are that the weight of the core would push the stud into the face of the mould, whereas a perforated box-type chaplet, used under the same conditions, would probably support the core quite satisfactorily because of its greater surface area. In dry-sand work of course, the stronger surface of the dried mould will naturally support a much-greater weight before collapsing under the pressure. Stalk chaplets are the best form of support when dealing with heavy cores, but again the end of the stalk must be in contact with a hard bearing surface, such as an iron plate or the bars of the moulding box, as illustrated in Figs. 8 and 9.

A change in the programme for the IBF National Works Visits Day to be held on October 27 has been announced. For visit F. Craven Bros. (Manchester), Limited, machine-tool makers of Reddish, near Stockport, will receive a party in the morning instead of Mather & Platt, Limited. (Party A, is now fully booked but there are vacant places on the others.)

Italian Bronze Statuettes

An exhibition of art castings carrying the title "Italian Bronze Statuettes" is currently being held at the Victoria and Albert Museum. It remains open until October 1 and is well worth a visit by founders who have even a passing interest in this section of their craft. The exhibition covers statuettes made in various provinces of Italy from the 15th to 18th century. From the foundry angle, the art castings divide themselves in three main categories, *viz.*: statuettes, medallions and plaques. Into the first group enter a number of perfume burners and in these, somewhat marring the appearance and apparently quite haphazardly placed are a series of roughly-made holes for the emission of the incense vapours. The need to incorporate such holes into the design stresses one of the handicaps under which craftsmen of that time were placed. The plaques, some of which carry lettering in very high relief, are of the type which will attract the attention and admiration of any who have an appreciation of foundry techniques. Yet from the viewpoint of a complete vandal and neglecting the great artistic and material value of the exhibits, the writer states without reservation that modern techniques can make art castings with an equal perfection of finish. One exhibit which attracted the attention of the reviewer was a composite bust where the head was of bronze and the shoulders of a well-matching type of marble. Visitors can borrow an exhibition catalogue on the payment of sixpence and no doubt they will be interested in inspecting also an area just outside the exhibition where Chinese bronzes, 1,000-years' old, are on view.

Casting . . . Pearls . . . .

A report that gems were so cheap and castings so valuable in the Isle of Majorca that pearls were being used as abrasives for barrelling castings led the JOURNAL to make enquiries from the foundry concerned. The story emanated from a British foundryman visitor to the Island, who was made welcome on a tour of the foundry of Casa Buades at Palma, a firm established in 1900, and producing in particular plumbers' brassware, valves and the like. "Imagine," he said, "there they were, literally *shovelling* pearls into the barrel along with the castings!"

It appears on further enquiry from the firm that the somewhat bizarre statement associating pearls with the cleaning of castings was in a degree incorrect. In actual fact, the castings produced are first deburred by barrelling them with granite chippings, after that, they are barrel-polished with limestone pebbles and chemical compounds. Finally, however, the last operation does indeed utilize discard pearls obtained from a factory nearby which produces the artificial variety. These are employed with excellent effect to burnish the brass castings by barrelling them in conjunction with a soap solution. In this, an executive of the firm states that they are only using the pearl discard in substitution for glass balls which were recommended to them by their London consultants.

Even so, readers may think that the association of castings and pearls is not too far fetched. (Thanks are recorded to the management of the enterprising Majorcan Foundry for permitting this comment on their processing methods.)

Aluminium Castings for Anodic Oxidation: When abstracting from the above paper by E. A. Bloch in the August 10 JOURNAL, it should have been pointed out that the original was delivered at the 27th International Foundry Congress.

US Steel Foundry adopts All-electric Melting

New Flexibility for High-alloy Castings

Castings ranging in size up to 30 tons can now be produced at the Birdsboro Corporation steel foundry at Birdsboro, Pennsylvania, as a result of conversion from acid openhearth furnaces to basic electric melting. Two new electric furnaces have been added, at a cost of nearly £¼ million, and together with an existing furnace installed five years ago, give a total melting capacity of up to 300 tons of steel a day.

The three electric furnaces have melting ranges of 4 to 9, 8 to 20, and 20 to 45 tons respectively, with average melts of 5, 15, and 28 tons. The new furnaces treble the foundry's electric capacity and with them it is now possible to make all foundry-type stainless and high-alloy steels, whereas hitherto only carbon and low-alloy steels were produced.

Other Installations

Removal of the open-hearth furnaces at the works will make way for further production-moulding equipment estimated to increase Birdsboro's capacity for miscellaneous castings by 20 per cent. to 1,250 tons a month. The change to all-electric melting has been accompanied by the installation of a new pneumatic system for handling sand which is expected to improve still further the quality of the castings, as well as save up to 60 per cent. of sand-handling costs. A sand dryer and two storage silos with combined capacity of 1,200 tons have also been added.

Wilmer Lea Proposal for Integration

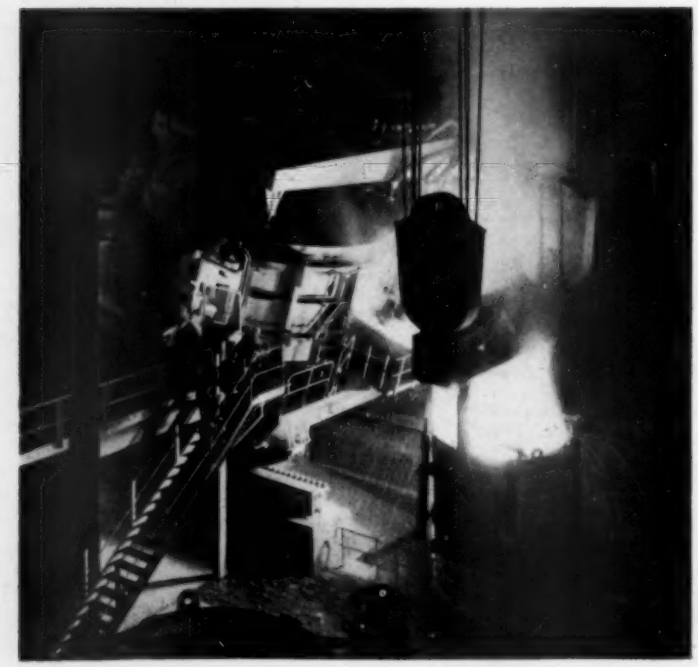
An integration plan is proposed by Wilmer Lea Foundries (Holdings), Limited, whereby the Charles Karen & Son (Holdings), Limited, group, which control Wilmer Lea, and eight non-trading companies will become wholly-owned subsidiaries. The consideration for the proposed acquisition is £655,000 to be satisfied as to £225,000 by the issue of 600,000 5s. ordinary of Wilmer Lea at 7s. 6d. A balance of £430,000 due to CKS Holdings will be secured by a debenture of which £230,000 will be convertible into 5s. ordinary, subject to consent. Wilmer Lea's present 1s. ordinary are to be consolidated into 5s. shares.

Subject to the integration scheme being carried into effect, Wilmer Lea or otherwise CKS Holdings will acquire the capital of Percy G. Thomas, Limited, tinplate merchants, of Neath (Glam), for £45,000. An extra-ordinary meeting of Wilmer Lea will be held on August 28 to approve the proposals. It is proposed to change the name of the company to C.K.S. Group United Metals, Limited.

Census of Production, 1958

The following parts of the Report on the Census of Production for 1958 may be obtained from H.M. Stationery Office at York House, Kingsway, London, W.C.2, and branches, or through booksellers: Part 53, General Mechanical Engineering; price 2s. 6d. (by post 2s. 8d.); Part 61, Miscellaneous Electrical Goods (2s., postage 2d.); Part 75, Miscellaneous Metal Manufactures (3s., postage 4d.).

ESC's 90-ton Electric-arc Furnace



Recently installed in the River Don Works of the English Steel Corporation, Limited, the electric-arc furnace shown in the photograph alongside is capable of melting 90 tons of steel in only three hours. The new plant, supplied by Birlec-Efco (Melting), Limited, has been designed for the production of special alloy steels and, in particular, for casting in vacuum. Its installation will enable the company to produce large "electric" steel ingots of improved quality to meet increasingly stringent specifications, and deliveries will also be improved because of the shortened heat-treatment times required for vacuum-treated steel as compared with steel cast by conventional methods. Working in conjunction with other melting furnaces it will enable English Steel to produce hydrogen-free ingots of up to 180 tons. The furnace is reported to be the largest in operation in the UK and the Commonwealth.

Notes from the Branches

Northampton Section

Thirty members of the Northampton and district section of the Institute of British Foundrymen went by coach to the British Bath Company's works at Greenford last month, for their final meeting in the 1960/61 session.

They arrived at the works at 10.30 a.m. where they were welcomed with coffee and split up into groups of seven or eight for a tour of the foundry and enamelling shop. The company, which employs 500 men, is producing 350 tons of castings per week on single shift. The castings, of various shaped baths, are made on two separate plants, one being the old section of the foundry where sandslingers are employed, and the other is the new section comprising a very modern arrangement of two large jolt/turnover moulding machines; each of the plants is capable of making a bath per minute.

Members particularly noted in some other foundries they had visited that in the not highly mechanized type the men's work had been arduous, and sometimes in the highly-mechanized type employees seemed to have insufficient to do, yet here at British Bath there was a combination of first-class manual effort linked with good mechanization.

Sand System

The sand system comprises hoppers of 250-ton capacity with rotary feed-tables and a separate additions-hopper for new sand, all of which feed to six- to two-ton capacity batch-type sand mixers and four of which work at one time. The sand is fed on 36-in. belts through two aerators to the moulding stations and probes in the hoppers operate electronically-controlled ploughs so that the system is semi-automatic and is operated by one man with a control panel stationed near the mixers. The finished moulds are conveyed by an unusual type of mould conveyor, past the pouring station and on to vibratory knockouts. The mould conveyor is composed of power-driven rollers which propel the moulding boxes forward and guide them at the same time and, in fact, there are no mould-conveyor tables or pallets as are generally used in mechanized foundries.

One of a pair of water-jacketed hot-blast cupolas, 5-ft. 6-in. bore dia., melts 14 tons of iron per hour from an all-scrap charge which is fed into the drop-bottom bucket-type swivelling charger by an electro-magnet on the stockyard crane. Coke and limestone are fed from overhead hoppers and the iron is continuously tapped into one of a pair of 3-ton capacity receivers. Slag is disposed of in specially made conical slag ladles on wheels and the iron is transferred from the receiver in 30 cwt. ladles carried on a Telfer system which extends to the pouring station. Here the metal is transferred to specially shaped ladles which contain just enough metal for one casting (300 lb.). The pouring ladles are fitted with twin spouts so that the casting is run very quickly (at the rate of 60 lb. per sec.) through twin downgates, one being at either side of the bath which is run from the bottom—the bath, of course, having been moulded upside down.

After shakeout the baths are moved on light bogies for cooling and then to the overhead chain-conveyor-type shotblast machine and into the fettling shop where the ingate studs are removed on a special-purpose grinder and light dressing carried out.

Enamelling Process

The next operation is to inspect and to apply a priming coat of paint before entry to the enamelling shop. Porcelain enamelling is a most interesting process and the visitors soon realized that the bath enameller combines artistry with his hot and arduous task. The bath is placed into an oil-fired preheating oven by the use of a 15-ft. long lifting fork and heated for 15 min. When red it is transferred to the enamelling oven alongside—this is very similar to the preheating oven but running at a higher temperature—and after a few minutes the bath is withdrawn for application of the enamel. The visitors were extremely interested in this process and particularly in the wide range of attractive colours going through the shop during the section's visit.

The tour of the works lasted five hours during which time the company provided luncheon, and a photograph of the party was taken together with Mr. G. R. Webster, director and general manager, Mr. P. Potter, works manager and the other guides. Immediately after luncheon, Mr. Webster formally welcomed the section members and said how pleased he was to hear

Photograph taken during the visit of members of the Northampton section to the works of the British Bath Company, Limited, at Greenford.

Notes from the Branches

such an interesting number of questions being asked. Mr. J. W. Deaton, junior vice-president deputizing for the section president, Mr. A. Tipper, who was unable to attend, thanked Mr. Webster for his hospitality and congratulated him on the excellent job the company was doing.

A further opportunity for questions was provided over a cup of tea at 4.0 p.m. after which the visit was completed and the coach took the visitors into London for a brief look at the Russian Exhibition prior to spending the evening in the West End.

It was agreed amongst those taking part that British Bath represented a rather special type of foundry but it was all the more interesting for that. The whole trip had been another very worthwhile event for Northampton section members, who find themselves having to travel further and further afield each year in order to find new and interesting works outside their own local experience.

Publications Received

Simple Guide to Ironfounding. Published by the Council of Ironfoundry Associations, 14, Pall Mall, London, S.W.1; price 5s. or 2s. 6d. per copy for bulk orders over 20 copies. One copy will be sent free to any school nominated by a foundry.

An excellent start is made in the brochure, which is written for school-leavers, by referring to the making of a jelly and then plaster casts of foot-prints. The story continues simply and quite logically, but is marred to a small degree by the printing of a somewhat muzzy photograph of a mechanized foundry, and the inclusion of the history of rocks. There is little use in blinding a neophyte moulder with science and this section could with advantage be simplified. The reviewer has nothing but praise for the section showing how a soleplate is made.

Boys are usually interested in motor-cycles and it was sensible to choose the cylinder as an example of foundry practice. Most of the article on this subject is carried out by means of picture captions, but not all. Consistency, it is thought, would improve the appearance of the story. Despite these minor criticisms, the book should well fulfil its objective in interesting the rising generation in the art and science of making iron castings.

(Following publication of *Simple Guide to Ironfounding* some three weeks ago, the Council of Ironfoundry Associations reports that over 2,500 copies have already been distributed, including sales of 1,500 to 60 companies and circulation to over 100 schools nominated by companies. Orders have also been received from Denmark, India and other Commonwealth countries. One interesting use of the booklet, which the CFA had not foreseen, is its distribution to visitors. One London firm is adding a page to the front of the booklet telling visitors to their works that they could not possibly see everything or get to know sufficient about the casting process in so short a period, so the booklet is offered to fill in the gaps.)

Ninety-seventh Annual Report on Alkali, etc., Works by the Chief Inspectors 1960. Published by HM Stationery Office, York House, Kingsway, London, W.C.2, price 4s. net (about 4s. 4d. post free).

Until the advent of the hot-blast cupola, the reviewer had never heard of the Alkali Works' division of the Ministry of Housing and Local Government, but now it is a very important body so far as the foundry industry is concerned. This is shown by the following extracts culled from this Report:—"Considering now the ironfounding side of the industry, the melting of iron in rotary and air furnaces calls for no considerable comment; the problems are those of smoke and dust. Here again the use of oxygen is developing and similar fume plant is being asked for. The major, serious and difficult matter is that of emissions from hot-blast cupolas. Last year's report stated that we had agreed the broad lines of a provisional "best practical means" for dealing with emission. Briefly they provided for the arrestment of grit and dust by cyclones, etc., and the dispersal of fume by a tall chimney. It was accepted on both sides that these measures were provisional to cover an interim period of experience. The agreement removed the uncertainty which was causing delay in decisions to install hot-blast cupolas. Operating experience with hot-blast cupolas fitted with the agreed means is still limited. In a few cases it is successful, in others the correct conditions have not yet been attained. During the year we expressed a doubt to industry whether the agreed means would be adequate to deal with some of the large plants which were planned, and intimated that arrestment rather than dispersal of fume might be necessary for these units. The task is one of great difficulty, and I am pleased to record that the Joint Iron Council has cordially accepted our suggestion that a working party of the industry and the Inspectorate be appointed to study the problems." Dealing with small arc furnaces, the Report reads: "Another problem concerns the small arc furnaces used in the steel-foundry industry. Some are very small, of but two or three tons capacity, yet they are often in well-populated areas and when being lanced with oxygen, they make their presence noted. We can see no alternative but to apply the same standard of 0.05 grain per cu. ft.; indeed the British Steel Founders' Association has been so informed. Some firms have already installed the necessary fume arrestment plant or are in the process of so doing. The fume plant is, of course, proportionately smaller."

A final extract is about the side-blown Tropenas (consistently mis-spelt Tropaena)—a word which could embellish a medical dictionary—and here we are informed: "A difficulty is the application to already existing units, and a greater one the uncertain future of the Bessemer process here. Once again some difficult decisions lie ahead. Some Tropenas operators feel that fume containment and cleaning will be such a major problem that they have decided to change to production by electric-arc furnaces. The Tropenas problem will be one of the major issues to be discussed with the British Steel Founders' Association in 1961."

The Iron Worker, Vol. XXV No. 3. Published by the Lynchburg Foundry Company, Lynchburg, Va., U.S.A.

This issue carries an article of outstanding historical interest; it tells of the connection of Augustine Washington's participation in the beginnings of iron-making in America. He was the father of George Washington and had connections with the United Kingdom as, from 1725 to 1743, it was the market for the pig-iron. However, some of the early American iron was cast into firebacks, cooking pots, garden-rollers and similar items. The technical section of the magazine is also of considerable interest. It describes and illustrates the mechanized moulding unit of the Lynchburg special foundry. Here an apron conveyor is used to carry the cast moulds not only through a tunnel but also into a smoke-exhausting room.

Equipment and Supplies

Shell-core Machine

As announced recently in the JOURNAL, Ernest Fairbairn, Limited, 376/379, Strand, London, W.C.2, have taken over the agency of the "Dependable" shell-core machines of US manufacture. A new range of models has recently been introduced, one of these, model 200, being shown in Fig. 1. The units are manufactured in four sizes, capable of producing cores singly or by multiple cavity up to a sand capacity for the largest size of about 2 cwt; they can be supplied with manual or automatic operation as required. The main features claimed for the new series are versatility, simplicity and economy. When delivered units are ready for immediate use by connecting with standard air and gas (mains or bottled) supply. In place of the more conventional electric heaters for such equipment, the corebox on the new model is heated by direct gas-jets through slotted faceplates, the numbers of jets being variable according to the size of core. Over-curing can be eliminated by thermostat control and the complete operational cycle is controlled from a visual timing mechanism. When fully-automatic cycling is arranged, the dump box is refilled during each cycle from a reserve sand hopper, thus enabling the operator to obtain fast operation. The machines can also be adapted for use with the "hot-box" method, it is reported.

Model 400

Additional information is supplied to the effect that one of the largest machines of this type, model 400, (fully-automatic) is producing in the USA shell cores weighing 207 lb., and 24-in. dia. by 24-in. overall depth; this core being used in a casting weighing 11 cwt. For this, the total investment, blow, cure and removal time is quoted as seven minutes; the aluminium coreboxes weigh over 3 cwt.

FIG. 1.—*"Dependable" model* 200 *shell-core machine with three-stage cycle control and thermostat, for cores of up to* 1 *cu. ft.* (*Ernest Fairbairn, Limited.*)

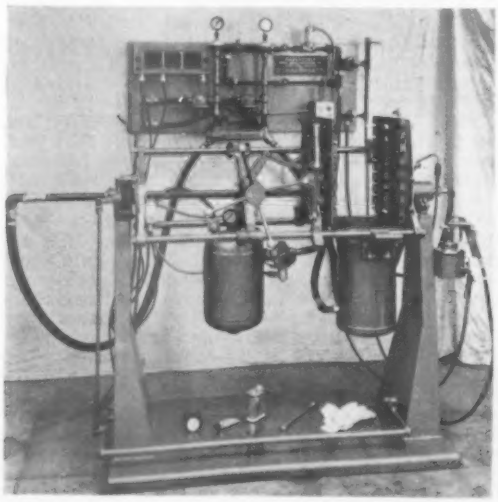


FIG. 2.—*Operator using a Permaply wooden patternplate assembly on a Macnab jolt/squeeze machine, at Plenty's of Newbury.*

Plywood Pattern Plates

Venesta Plywood, Limited, Queen Street Place, London, E.C.4, have supplied the following account of the application of their "Permaply" grade of resin-impregnated plywood for pattern plates in the iron foundry of Plenty & Son, Limited, of Newbury. The founders, manufacturers of a wide variety of heavy engineering equipment, report that they find the plywood cheaper and much lighter and easier to handle than the cast iron previously used. As a result of the impregation of the plywood with resin, it is claimed that it is unaffected by moisture and does not warp, a fact of importance when moulding with moist sand.

Pattern plates at the Newbury foundry are ¾-in. thick, used in two standard sizes, 14 by 16 in., and 24 by 24 in., and are expected to support loads of up to 5 cwt., whilst being rapidly jolted. For example, a plate on a Macnab jolt/squeeze moulding machine (Fig. 2) is supported only by a 1½-in. strip around its edge. On smaller machines, a pressure of 80 lb. per sq. in. is applied to the top of the sand by the pressure-plate. The foundry is reported to have been using this type of pattern for about five years.

Metallographic Specimens (Annotated)

Metallurgical Services, Reliant Works, Betchworth, Surrey, report that they are able to supply annotated metallographic specimens, presenting the basic features of metallographic structures and, at the same time, covering a wide range of industrial materials, both ferrous and non-ferrous, in cast, wrought and heat-treated conditions. For cast materials, transverse specimens are supplied ¾-in. thick, and the metallurgical condition of each specimen is clearly recorded, and the composition is given either as a close nominal figure—or more usually in the form of analysis figures. Sets of specimens available include cast-aluminium alloys (10 specimens), bearing- and type-metals, zinc-die-casting alloys (six specimens), and specially-

Equipment and Supplies

prepared grey and white cast irons, sand-cast to ¾-in. dia. (13 specimens). The latter include five series of specimens selected to reveal effect of carbon and silicon on grey irons, effect of carbon and phosphorus in white irons and under-cooled graphite in grey iron. Then there is another group of ordinary foundry irons, sand-cast to ¾-in. dia. (six specimens). The list continues with malleable and spheroidal-graphite irons, sand-cast to ¾-in. dia. under commercial conditions (seven specimens); alloy cast irons (eight specimens) sand-cast commercially as ¾-in. dia. bar; cast and wrought copper specimens (10 specimens); aluminium-bronzes (11 specimens); tin-bronzes and gunmetals (seven specimens); magnesium alloys (six specimens), and cast steels (seven specimens). The firm issues a priced catalogue which details a complete list of specimens available and forthcoming sets which are being prepared. Also offered are consulting facilities on metallographic problems, and advice on laboratory installations.

Dust Respirator

The protective-equipment division of Martindale Electric Company, Limited, Westmorland Road, London, N.W.9, has introduced a new dust-respirator which it is claimed provides protection against dusts as fine as 0.5 micron and smaller. Known as the Martindale heavy-duty respirator, the face-piece and filter-box are made from lightweight plastic materials and the complete respirator weighs only 4½ oz. The filter-box is of triangular shape to ensure unimpaired vision and the face-piece can be moulded with the fingers to effect a comfortable seal on any shape or size of face. The manufacturers state that the respirator is approved by HM Factory Inspectorate for use under the Iron and Steel Foundries Regulations 1953.

British Chemical Standards

Bureau of Analysed Samples, Limited, from Newham Hall, Middlesbrough, announce the issue of the following new British chemical and spectrographic standard samples: B.C.S. No. 300—6 per cent. zinc/aluminium alloy (analysed for Cu, Mn, Si, Mg, Fe, Ti, Cr and Zn); B.C.S. No. 304—10 per cent. aluminium-bronze (analysed for Cu, Zn, Ni, Fe, Mn, Si and Al); B.C.S. No. 305—75 per cent. ferro-silicon (P, Al, Ca and Si); B.C.S. No. 306—0.4 per cent. carbon free-cutting steel (Si, S, P, Mn and C). These samples are only available in the finely divided form for chemical analysis. Series S.S. Nos. 21-24, however, a series of low-tungsten steels have been standardized for tungsten only (tungsten contents ranging from 0.7 to 3.4 per cent.) and are supplied in the form of ¾-in. dia. rods, each 3-in. long, for use as spectrographic standards. This range is also available in the form of turnings for chemical analysis, bearing the reference numbers B.C.S. 281-284.

Air Cylinders: Air Automation, 26, Sharrocks Street, Wolverhampton, have recently introduced a new range of square-ended air cylinders of tie-bar construction. The first sizes to be available are those of ¾-in. and 1-in. bore in single acting, double acting, and single acting spring return patterns. Features claimed include stainless-steel rods, brass bodies, and neoprene distributor type "U" seals for both rod and piston. All are provided with screwed nose, front-face mounting, and rear trunnion mounting, as well as screwed base mounting, and additional front-flange mounting-plates or foot mounting-plates can also be supplied if required.

Elapsed-time Indicator: English Electric Company, Limited, English Electric House, Strand, London, W.C.2, have developed an elapsed-time meter for recording the time a piece of equipment has been in use. The meter, normally connected so that it is automatically switched on and off with the apparatus being metered, is designed to register up to 9999.9 hours in steps of 0.1 hr. The cyclometer register is driven by a self-starting, non-reversing, synchronous motor, through a train of gears, and operation is on a.c. supply in the voltage ranges 100-125, 200-225, and 400-440 of frequency 50 or 60 cycles.

Magnetic Safeguard: Rapid Magnetic, Limited, Lombard Street, Birmingham, 12, have introduced means of avoiding premature release (due to electricity supply failure) of "tramp iron" extracted by electro-suspension magnets. Auxiliary built-in permanent magnets retain the collected iron until the holding force is neutralized by operating the contactor controller and reversing the current. This technique can be applied to any of the range of circular, square or rectangular suspension magnets produced by the company.

Laboratory Furniture: Griffin & George, Limited, and Grundy Equipment, Limited, who have been long associated in the manufacture and marketing of metal laboratory furniture and apparatus, announce a new arrangement whereby the Grundy group becomes responsible also for the manufacture of wood laboratory furniture at their Cowley, Middx, and Mitcham Joinery Works. Marketing will continue to be handled solely by Griffin & George (Laboratory Construction), Limited, whose sales department operates from High Street, Cowley, Uxbridge, Middx.

Resin Curing-agent: Shell Chemical Company, Limited, announce the addition of "Epikure" TET to their range of products, bringing the number of cold-curing agents for use with "Epikote" resins to four. It is claimed to be suitable where there is a need to cast slightly larger masses than is possible with the firm's other curing agents and still effect a cure at room temperature. The "exotherm" of this system on cure is stated to be lower than with the others.

Alloy-steel: Samuel Fox & Company, Limited, a subsidiary of United Steel Companies, Limited, have commenced commercial production of a new alloy-steel designed for service temperatures up to 675 deg. C. Known as Esshete 1250, it is a 15 per cent. chromium, 10 per cent. nickel, 6 per cent. manganese steel, with smaller percentages of silicon, molybdenum, vanadium, niobium and boron.

Plastic Protection for Bandsaws.—Hack Saws, Limited, Capel Street, Sheffield, 6, are now supplying bandsaws with a yellow plastic strip covering the entire toothed edge. The strip protects from injury the person uncoiling the bandsaw, the saw teeth from damage resulting from accidental metal to metal contact, and simplifies packing by making the usual paper and sacking unnecessary.

Ferro-alloys: Industrial Enterprises of 71, Canning Street, Calcutta, 1, India, write that they would like to hear from UK manufacturers of ferro-silicon, ferro-vanadium, ferro-molybdenum, ferro-titanium, ferro-tungsten, ferro-manganese, ferro-chrome and tungsten metal powder, with a view to importing into India.

Personal

Mr. W. S. SINCLAIR has been appointed manager of the Cardiff office of the Incandescent group of companies.

Mr. D. R. WALKER has been appointed secretary of the Vitreous Enamel Development Council, 28, Welbeck Street, London, W.1.

Mr. J. S. ALLCARD, sales director of Easterbrook, Allcard & Company, Limited, Sheffield, has been elected Prime Warden of the Worshipful Company of Blacksmiths.

Mr. P. HOYLE has been appointed to the board of Rownson Conveyors, Limited, a member of the Baker Perkins group. He continues as deputy manager of the bakery and machinery department of the parent company.

Mr. F. W. CLIBBERY has been appointed managing director of Amal, Limited, a subsidiary of Imperial Chemical Industries, Limited. Mr. R. G. HUTCHINGS and Mr. D. S. IZON have been appointed directors of the subsidiary.

Mr. R. F. LANG, managing director of the wholly owned subsidiary, F. Francis & Sons, Limited, has been elected a director of E. Francis & Sons (Holdings), Limited, ironfounders and engineers, Thames Ironworks, London, S.E.13.

Mr. E. CARS, previously works director of the Moss Gear Company, Limited, has been appointed joint managing director in place of Mr. J. R. HUDSON, who has retired after 43 years with the company. Mr. J. T. RILEY has been appointed works director.

Professor M. W. THRING, head of the department of fuel technology and chemical engineering at Sheffield University, has returned from a fortnight in the Argentine where he has been helping in the setting-up of a similar department at the University of Buenos Aires.

Mr. E. W. B. OWEN, Mr. E. M. DE WINDT and Mr. R. K. NELSON have joined the board of Eaton Axles, Limited. Mr. Owen is joint managing director of Rubery Owen & Company, Limited, and Mr. de Windt is vice-president of Eaton Manufacturing Company, Limited, associated companies of Eaton Axles.

Mr. WALTER GEORGE THOMPSON, Sheffield area superintendent of AEI Lamp and Lighting Company, Limited, for the past seven years, has retired after over 50 years' service with the company. He is succeeded by Mr. EDWARD MADDERS, who has been senior lighting engineer at Sheffield for the past five years.

Mr. W. F. HAYLES, who for several years has been controller of purchases and stores of the Tata Iron and Steel Company, Limited, Jamshedpur, joined Tata, Limited, on August 1, as controller of purchases, steel. In that capacity, he will be dealing with the enquiries and orders that Tata, Limited, issue on behalf of Tisco.

Colin Stewart, Limited, Winsford, Cheshire, announce that Mr. E. W. RIDGWAY has resigned from the company with effect from August 31, and is joining H. McCaig & Company, Limited, of Falkirk, Scotland. Mr F. S. SMITH has been appointed sales manager of Colin Stewart with effect from the same date.

Air Marshal Sir COLIN W. WEEDON is resigning from his present executive duties as director and general manager, commercial sales, of the aero engine division of Rolls-Royce, Limited. Sir Colin, who joined Rolls-Royce in 1952, will continue with the company as a senior aero-engine division representative.

Mr. BRIAN RICHARDS HILL, a trainee with the Lincoln engineering firm of Ruston and Hornsby, Limited, has been awarded a travelling scholarship of the Institution of Mechanical Engineers. The scholarship, a James Clayton Fellowship, will enable Mr. Hill, who is 23, to spend 12 months studying production methods on the Continent.

Mr. JOHN BLINCH, until recently, director and secretary of the Purchasing Officers' Association, has joined the board of Industrial Education International, Limited, and its associated company Materials Management International, Limited, and will be responsible for the work of these two organizations in Europe. For the time being he is continuing to hold the office of honorary secretary for the European Federation of Purchasing.

His Excellency Dr. AZIZ SIDKY, Central Minister of Industry in the United Arab Republic, and chairman of the general organisation for executing the Five-year Industrial Plan, arrived in the United Kingdom last Monday, on an official visit at the invitation of Her Majesty's Government. He will meet representatives of a number of British firms interested in supplying machinery and equipment for use in the United Arab Republic's five-year plan.

Following a recent illness, Mr. D. R. MACKIE, at his own request, has resigned from his position as managing director of Monsanto Chemicals, Limited, with effect from October 1. He continues as a member of the board. Mr. Mackie will be succeeded as managing director by Mr. JOHN C. GARRELS, JNR., deputy managing director, who joined Monsanto Chemicals from the plastics division of its American parent company at the beginning of 1961.

Mr. H. I. F. EVERNDEN, who designed a range of Rolls-Royce cars starting with the first Continental model and ending with the Silver Wraith, retired on August 11 from the post of chief project engineer to the Rolls-Royce motor-car division. He joined the company in 1917 and in 1941, when the whole of Rolls-Royce resources were turned over to the production of aircraft engines, Mr. Evernden was given a staff of six and told to continue development work on motor cars. Instead he adapted Rolls-Royce engines to army tanks and was awarded the M.B.E. for his work.

Obituary

A memorial service to Major HENRY WATLING, formerly director of the Cycle and Motor Cycle Industries Association, was held at Kenilworth, Warwickshire, on August 8.

Mr. JOHN BILTON, production manager at Newton Chambers & Company, Limited, Chapeltown, Sheffield, was found dead in his stationary car at the works on August 8. He was 52.

Mr. W. J. V. WARD, chairman of the Billingham division of Imperial Chemical Industries, Limited, died on August 11 at the age of 58. He went to Billingham as a research chemist in 1926, and from 1933 for the next 10 years he was associated with further research work in the refinement of petrol. Mr. Ward joined the directorate staff as chief technical assistant in 1936. In 1940 he moved to Heysham Works as manager, and returned to Billingham in 1944. In 1955 he succeeded Dr. G. I. Higson as chairman of the division.

Company News

Indian Iron & Steel Company, Limited

Although a higher level of production was achieved by the Indian Iron & Steel Company, Limited, in 1960/61 than in the previous year, deterioration in the quality and supply of coking coal and limestone may make it impossible to achieve the output envisaged at the time the plant extensions were planned, warns Sir Biren Mookerjee, chairman, in his annual statement. "In fact," he states, "grave difficulties are foreseen in maintaining future production even at the 1960/61 level."

The chairman says that blast-furnace operations throughout the year to March 31, 1961, were carried out under difficult conditions due to the extremely high and varying ash content of the coke caused by the poor quality and erratic supplies of metallurgical coke, and also because of the deterioration in the quality of limestone supplies. The quantity and quality of iron produced was affected, which in turn imposed difficult production conditions on the steel melting shop.

The improvement in tonnage, despite these conditions, would have been greater, says the chairman, but for the loss of output resulting from the strike of railway employees in July, 1960. Output at the Kulti foundries again showed improvement due mainly to increased production by the spun pipe plants. These increases were reflected in improved trading results.

Steel Output

Production of steel ingots and castings by the company in 1960/61 was 914,159 metric tons, compared with 840,305 tons in the previous year. Output figures for saleable steel, with the figure for the previous year in parentheses, were:—Bars, 132,738 (56,764) tons; structurals, 153,165 (158,889) tons; black sheets, 79,701 (76,827) tons; galvanized sheets, 69,364 (64,688) tons; blooms, slabs and billets, 219,231 (244,208) tons. Production of pig-iron was 1,160,576 (1,070,470) tons; coke, 1,359,779 (1,364,558) tons; and iron castings, 217,294 (178,695) tons.

Referring to the company's expansion programmes, the chairman says that all major items of plant under the 1953 and 1955 programmes were completed with the commissioning on June 10, 1960, of the new bar and rod mill. Efforts are now being concentrated on the provision of subsidiary services designed to improve the efficiency of the expanded plant. Work has started on the modernization of the 34-in. mill stands, and completion of this work is envisaged by November, 1961.

IMPERIAL CHEMICAL INDUSTRIES, LIMITED—The offer to members of Settle Limes, Limited, quarry owners and lime burners, of Settle (Yorks), has been accepted in respect of 90 per cent. of the shares concerned and is now unconditional.

BALFOUR & DARWINS, LIMITED—The offers for the issued capital of Arthur Balfour & Company, Limited, and of Darwins Group, Limited, by Balfour & Darwins, the holding company formed to effect the merger, have been declared unconditional, subject to permission to deal on the London Stock Exchange and quotation for the capital of the new company being granted. The expiry dates have been extended to September 7. Acceptances have been received for 95 per cent. of the capital of Arthur Balfour and 84.1 per cent. and 90.6 per cent. respectively of the preference and ordinary capital of Darwins.

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d.)

847,909. Metropolitan-Vickers Electrical Company, Limited (now A.E.I., Limited), St. Paul's Corner, 1-3 St. Paul's Churchyard, London, E.C.4.

The manufacture of casting moulds or cores from a mass of discrete particles of a refractory material held together by a binder solution of aluminium phosphate in dilute orthophosphoric acid. (See also B.P. 812,352, FOUNDRY TRADE JOURNAL, February 11, 1960).

848,386. Foundry Services, Limited, Long Acre, Nechells, Birmingham, 7.

Hot-tops, feeders, etc., for use in the casting of metals. (See also B.P. 829,156, JOURNAL, January 26, 1961).

848,532. Aluminium Laboratories, Limited, 1800 Sun Life Building, Montreal, 2, Canada.

The continuous casting of metal rod or strip by the rotating-wheel method. This present invention provides means for automatically controlling the level of molten metal, which is achieved by using an immersed liquid-level detector in the pool of metal in the groove at the top of the wheel.

848,604. Vagn Aage Jeppesen, 10 Ulvemosevej, Rungsted, Denmark.

An apparatus for producing so-called stack moulds, *i.e.* those of sand or similar material consisting of uniform mould parts assembled with each other and presenting mould faces for forming one or more casting cavities at each joint in the moulds. It is claimed that reduction in foundry costs can be obtained by putting this invention into practice.

848,852. Fritz Hansberg, 13 Via Archirola, Modena, Italy.

An improvement in foundry machines of the type wherein the core or mould sand is introduced into the boxes by compressed air. (See also B.P. 763,036, JOURNAL, January 31, 1957).

849,127. Birfield Engineering, Limited, Stratford House, Stratford Place, London, W.1.

A casting machine which will enable a number of castings to be made quickly and with less likelihood than hitherto of containing faults due to dross on the surface of the charge of metal being fed into the moulds.

849,221. Badische Maschinenfabrik A.G., Seboldwerk, 1, Seboldstrasse, Karlsruhe-Durlach, Germany.

A device for aligning (pinning) the upper flask section of moulds with the lower flask section.

Photostat copies of the following Australian Patent are available from the UK Patent Office, price 9d. per page. The address given is that of the agent for Service.

229,402. Union Carbide Corporation, c/o Edwd. Waters and Sons, 422-428, Collins Street, Melbourne, Victoria. (12 pages.)

A non-exothermic addition agent, containing an organic binder and alloying metal or alloy for incorporation into a steel bath or melt. This addition agent comprises from 88 to 90.5 per cent. by weight of an electrolytic manganese, aluminium or chromium or a ferro-titanium, ferro-manganese, or ferro-chromium alloy, and from 0.5 to 12 per cent. by weight of a resin binder.

News in Brief

THE *Bureau International de la Récupération* is to hold its autumn meeting on November 16 and 17 at the Carlton Hotel in Amsterdam.

THE MINES DEPARTMENT has prepared a new bulletin dealing with the geology and mineral resources of Southern Eyre Peninsula, in South Australia.

A NEW CONTRACT from Glasgow Corporation brings the value of home bus orders placed with Leyland Motors, Limited, in recent months to well over £2,000,000.

TWO NEW TECHNICAL REPRESENTATIVES of the Suffolk Iron Foundry (1920), Limited, are Mr. H. Johnson, who will cover Lancashire and the North West coast, and Mr. H. B. Travis, representative for Yorkshire and the North East coast.

BRITISH MOULDING MACHINE COMPANY, LIMITED, Faversham, Kent, announce that they will be demonstating their BQ.1 automatic moulding machine (producing copes and drags simultaneously) at the Zagreb Fair, to be held from September 9 to 24.

BARCLAYS BANK D.C.O. states that it has been reported that a Canadian Company, Magnet Consolidated Mines, Limited, of Toronto, is seeking permission to mine bauxite in Jamaica and that the application is now under consideration by the Ministry of Development.

THE NATIONAL MALLEABLE AND STEEL CASTING COMPANY, of the USA, will give financial and technical assistance to Metalúrgica Peruana, of Lima, Peru, for the installation of a foundry for iron, steel and non-ferrous metal products. The foundry will have an initial production of 20,000 tons per annum.

LOOKING AHEAD, Qualcast, Limited, Derby, have informed 1,500 employees that their holiday next year will be brought forward to July. A statement by the directors explained that a "comprehensive survey" of the requirements of customers in the motor industry had shown that the earlier holiday was desirable.

ALBION MOTORS, LIMITED, Glasgow, which shelved plans for a Dumbarton factory last autumn, are to build a big extension to their Scotstoun works. The move could give Scotland several hundred more jobs in the industry within the near future. The firm is still determined to go ahead with its Dumbarton project later.

AN ORDER for the first British all-refrigerated stern trawler has been received by Hall, Russell & Company, Limited, Aberdeen, from J. Marr & Son, Limited, Hull. The vessel will have an over-all length of 240 ft. and diesel electric machinery for propulsion and electric generation will be supplied by the English Electric Company, Limited.

THREE INTERNATIONALLY-KNOWN MINING COMPANIES—Consolidated Gold Fields (Aust.) Pty., Limited, Utah Mining and Construction Company, and Cyprus Mines Corporation of Los Angeles—which have formed a joint venture to carry out iron-ore exploration in Western Australia, will together start prospecting for the ore in the Ellaerine Hills region, east of Port Hedland.

SIMONS-LOBNITZ, LIMITED, Renfrew, have secured a £550,000 order for a twin-screw salvage tug for the Commissioners for the Port of Calcutta. This success follows recent orders from Rangoon, Clyde Navigation Trust, and the Suez Canal Authority, and was achieved in the face of stiff European and Japanese competition. In the past three months the Renfrew yard has secured orders worth £2,250,000.

OVER 4,000 PEOPLE attended the annual gala of J. & J. Dyson, Limited, Sports and Social Club at Sheffield on August 7. A special attraction was a model train made by two of the works fitters, Mr. Leslie Harper and Mr. Terry Green. They used a Morris 10 engine, an Austin 8 differential, and Bedford half-shafts. The train made two trips along 130 yards of track every five minutes.

CINTRIDE, LIMITED, manufacturers of tungsten-carbide hard-metal tips and tipped tools, Ecclesfield Road, Sheffield, is moving to new premises on a five-acre site in Ashford Road, Bakewell, Derbyshire. At present there are 10,000 sq. ft. of works on the Bakewell site, but eventually it is anticipated that the new works will have an area of 120,000 sq. ft. and employ 1,200 people. The move will take five or six years.

THE NORWEGIAN INTERESTS in the projected factory at Horten, on the Oslo Fjord, for the manufacture of a small plastic-bodied car to be called "Noble Viking," have withdrawn their support. According to the chairman of the Horten Council, which had given the project substantial backing, the Norwegian interests are withdrawing because the British originators of the plans have not managed to secure the required capital.

FOUR FIREMEN had to crawl on their stomachs to fight a blazing conveyor belt in an underground channel at a foundry in Burton on Trent recently. About 50-ft. of the rubber conveyor belt was completely destroyed. Because of its awkward position, four firemen, two from each end, crawled into the underground channel to the scene of the blaze to play hose-reel jets on it. All the time they were hampered by thick black smoke.

A NEW POWER PROJECT under construction will nearly double electrical generating capacity in Victoria, Australia. The project reflects the growing demand for electrical power for all phases of industry throughout Australia. The new plant in Victoria is being built at Hazelwood, in the Latrobe Valley, at a cost of £A120,000,000, and will have an output of 1,200,000 kw when completed in 1971. The first stage will be in operation in 1964.

GENERAL ELECTRIC COMPANY, LIMITED, are to transfer manufacture of domestic refrigerators from plants in the London area to the main appliance factory at Swinton, near Mexborough, to effect economies in production costs. It is not expected that the transfer will be fully effective before early 1962. About 500 employees at the London factories are involved but it is unlikely that there will be any great move of staff from London to Swinton.

JOHN BROWN CONSTRUCTORS, LIMITED, a member of the John Brown Engineering group, has announced a £2,000,000 order from Poland, for the design, supply and installation of three chemical plants at Tarnow. These works will produce enough oxygen and nitrogen to make 1,000 tons of ammonia a day, or several thousand tons of artificial fertilizers. This is the first British firm to win a contract for "tonnage" oxygen plant in Eastern Europe.

THE ACTION of the Australian Government in forcing the motor industry to cut production has been defended by Prime Minister Menzies, who said it had been necessary to make the Government's anti-inflationary measures effective. He said that the motor industry had been going too fast and too far. It had been producing about 350,000 vehicles a year for 10,000,000 people, and the Government had acted against the boom situation before it led to a depression.

News in Brief

THE COMBUSTION ENGINEERING ASSOCIATION are staging a working display of mechanical coal- and ash-handling equipment at Salford Goods Yard on September 19, 20, and 21. Times of the display are 10 a.m. to 12.30 p.m. and 2.30 to 4.30 p.m. Equipment to be seen includes economic boilers with complete mechanical coal-handling and ash-removal equipment, belt conveyors, cranes and grabs, mechanical stokers, loaders, delivery vehicles, vending machines, monorail transporter and sack lifters.

THE NINTH INTERNATIONAL AUTOMOBILE TECHNICAL CONGRESS of the Fédération Internationale des Sociétés d'Ingenieurs des Techniques de l'Automobile (FISITA) is to be held in this country from April 30 to May 5, 1962, the organizers being the Institution of Mechanical Engineers (automobile division). Those wishing to have full details of the programme should write to FISITA, Congress Secretariat, Institution of Mechanical Engineers, Automobile Division, 1, Birdcage Walk, Westminster, London, S.W.1.

IN THE FACE OF STRONG COMPETITION from German and Japanese companies, Carblox, Limited, carbon-brick manufacturing company of the Marshall Refractories group of Sheffield, have secured a £100,000 order for a lining for a new blast furnace to be built near Athens. The company will also supply firebrick linings and checker fillings for the two hot-blast stoves which will be built for operation with the blast furnace. This new plant—the first blast furnace in Greece—will be built by Acieries Halivourgiki S.A. of Athens.

METAL INDUSTRIES (EUROPE) S.A., a company in the Metal Industries group, has secured an order, through its office in The Hague, for the complete electrical equipment of eight harbour cranes for the Amsterdam Harbour Board. The contract, which is valued at nearly £50,000, calls for the supply of automatic control panels, motors and installation. The control panels will be manufactured by Brookhirst Igranic at Bedford and the motors by Lancashire Dynamo & Crypto at Trafford Park. The cranes are being supplied by Krupp-Ardelt, Wilhelmshaven, Germany.

ERNEST SCOTT & COMPANY, LIMITED, Leven, Fife, fully-owned subsidiary of Henry Balfour & Company, Limited, Leven, announce a £480,000 contract. The order, from Millspaugh Wimpey, Limited, is for a complete soda-recovery unit for a pulp and paper mill destined for Yugoslavia. In addition the firm has secured a similar, but smaller, contract for Ballarpur Paper Mills, India, valued at £90,000, and a contract for a further evaporation plant for Mysore Paper Mills, India, valued at £56,000. Henry Balfour & Company are to erect a steel-framed building for use as a heavy fabrication shop at Mountfleurie, Leven, at a cost of £100,000. It is hoped the new building will be finished by next June.

THREE SCOTTISH FIRMS—Harland & Wolff, Limited, Glasgow, John Brown & Company, Limited, Clydebank, and Associated Electrical Industries, Limited, Glasgow—are to share in a multi-million pound order for the world's most powerful pumping and generating equipment. Two 100,000-kw generating sets are to be built by Harland & Wolff and two by A.E.I., and John Brown is to make the pump-turbines for the Loch Awe scheme, due to go into operation by 1964. The work has been sub-contracted to the Scottish firms by English Electric, Limited, and Associated Electrical Industries, Limited. Total value of the contract has not been revealed but it will account for a large part of the hydro board's £25,000,000 expenditure on the Loch Awe scheme.

Catalogues

Electrical Dust-precipitators. In publication No. 87, W. C. Holmes & Company, Limited, Turnbridge, Huddersfield, describe and illustrate the Holmes-Elex system of gas cleaning. This electrical system is different from the mechanical collectors as it collects particles of dust irrespective of their size. The modern plants are fitted with rapping plates to free the electrodes from dust. A current application is the removal of iron-oxide fume arising from oxygen blows. The brochure is of pleasing appearance and is well illustrated.

Pressure-die-casting Machines. An Italian firm, A. Triulzi, of Milan, who are represented in this country by Alexander Cardew, Limited, 2, 3 and 5, Studio Place, Kennerton Street, Knightsbridge, London, S.W.1, have issued an eight-page illustrated brochure which covers a wide range of sizes for their Castmatic pressure-die-casting machines. The range goes from 120 to 2,200 tons. Testing of the 2,200-ton machine was recently carried out at the Milan works with a 45-lb. cylinder-block for the Volga motor-car (details to be printed shortly).

Automation and Process Control. Automatic Control Engineering, Limited, Roxby Place, Seagrave Road, London, S.W.6, have issued a well-illustrated brochure which tells of the origin of the company—it is a subsidiary of Constructors John Brown, Limited—and details the services it gives to companies which decide to change over sections of their automatic control. The brochure shows many installations carried out by the firm in a wide range of industries.

Valves. Wilkinson Rubber Linatex, Limited, Camberley, have issued a 28-page brochure which tells of the increased range of the firm's rubber-incorporated valves now available for a much wider sphere of applications. Especially are these valves useful for liquids containing solid in suspensions and chemicals. The changing of linings or other rubber components is said to be quite simple and provide what is virtually a new valve.

Castable Refractories. Silbond Refractories, Limited, 29, Crofton Avenue, Sheffield, 6, have issued a catalogue in two formats, the smaller one of which carries a blue plastic cover, and the other a white one; both are embellished with a pseudo atomic-structure emblem. The booklet gives the properties and method of numbering proprietary brands of bagged refractories to be used as cements for patching or for the building of monolithic linings.

Fibre Glass. Turner Brothers Asbestos Company, Limited, Rochdale—a member of the Turner & Newall group—deal, in publication D 6, with their Duraglas and Duramat products. The information disclosed is of distinct interest to those patternmakers who are making reinforced plastic resin patterns. The brochure carries an offer of help in the solution of technical problems.

Mobile X-ray Equipment. Pantak, Limited, Vale Road, Windsor, Berks, in a folder-leaflet illustrate a range of mobile constant potential X-ray units, and give details of the control units, generators, tube shields, tubes and cooling systems embodied.

Photo by permission of Esso Petroleum Co. Ltd. Purfleet, Essex.

H IS FOR HOSES at Esso Petroleum Co., Ltd., Purfleet, Essex where 300 lengths of Goodyear oil discharge hose are used in the ships exchange layout, the batch blending section of the new lubricating oil warehouse and the road/rail tanker loading bays. Resisting attack by mineral oils, greases and most industrial solvents, Goodyear Oil Hose is immensely strong yet flexible, with a tough cover that stands up to abrasion and gouging. It is one of more than 500 types of Goodyear hose built for specific needs—Write today for full information.

GOODYEAR

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Raw Material Markets

Iron and Steel

Annual holidays will continue to reduce normal outputs of castings, but a fair proportion of the foundries will be able to resume work with a fair amount of business on hand. However, most of them would welcome a bigger demand than that recently obtained, particularly so far as their forward commitments are concerned.

Most of the engineering and speciality foundries have been able to maintain a five-day working week with the orders on hand from the many trades to which they supply high quality castings, but in some instances this rate of working has been in excess of orders arising and with the backlog of work completed, additional business will be required if they are to maintain recent output levels. Demands from the motor vehicle industry are at reasonably good levels, but much lower than formerly, and while many other important consumers including heavy engineering, power and electrical plant manufacturers, steelworks, and the machine tool trade continue to use appreciable quantities of castings, overall recent requests for supplies have been on a fluctuating basis.

Many of the light foundries are still short of work; those supplying castings chiefly for domestic utensils being the least gainfully employed. Those foundries catering for the building trades continue to receive good support, but most of the jobbing and textile foundries are in need of more work.

All the iron foundries are well supplied with pig-iron, scrap, etc. Plentiful supplies of pig-iron in all grades are at their disposal and most producers could step up deliveries appreciably if called upon to do so. The steelworks are also well supplied with their requirements of basic pig-iron. Buyers overseas continue to take up consignments in all grades, but more could be shipped if orders could be secured against the strong competition from continental and other makers abroad. Foundry coke, ganister, limestone, and firebricks are in good supply.

Production at the re-rollers continues on a reduced scale on account of holiday influences. Demands for most of their products are well below capacity levels, particularly for small bars, light sections, bright drawn bars, and strip. Orders arising are readily undertaken with the result that they have little forward commitments; in fact difficulty is experienced in obtaining sufficient tonnage to make up current rollings.

Adequate supplies of mild steel semis can be obtained from home steelworks which have tonnages to spare. Carbon steel billets are more plentiful, and while alloy steels are being offered more freely, in some instances these are for deferred delivery, as producers are fairly heavily committed for these special grades.

With the reduced work on hand, arisings at the steelworks of defectives and crops are not being accepted so readily by the re-rollers.

Non-ferrous Metals

Postponement of the International Tin Council's much-publicized August meeting until mid-September, caused a drop in prices of around £4 a ton. Even so, the price of the white metal at over £940 a ton last week was at its highest point for eight years and compares with its price of only £779 a ton on January 12 this year. In the US the market is steady and the price is not now far short of $1.20 a pound. Singapore is steady to strong and and the price is showing a gradual but persistent rise.

The outlook for copper is much improved, but any real upward swing in the London quotation will depend on whether the Rhodesian situation gets out of hand, as there are still more than 21,000 tons in LME warehouses. In the US, the latest copper figures are disappointing and no upturn in demand is expected before the final quarter of this year. The producers and custom smelters continue to quote 31 cents a pound. However, the scrap position is much tighter and the price for No. 2 scrap has risen to 26¼ cents a pound.

Lead in London continues to be a neglected market with the price moving narrowly around £64 a ton. In the US the market is quiet with the price unchanged at 11 cents a pound.

Zinc in London, which is fractionally below £77 a ton, is at its lowest level for over two years. This is due to poor demand and abundant imports—those from Russia and the Congo in recent months replacing those from the United States which came into the country earlier in the year. In the US the market is featureless with the quotation for East St. Louis spot unaltered at 11¼ cents a pound.

Exhibitions

European Machine Tool Exhibition

The seventh European Machine Tool Exhibition will be held this year in Brussels from September 3 to 12. Among those exhibiting will be: T.A.L. Numatics, Limited (stand no. 3527, Hall, 3), who will show their range of air-control equipment; Brooke Tool Automation, Limited (stand no. 4329); the Morrisflex Group (stand no. 3131), makers of abrasive-wheel cut-off machines and pneumatic tools; and A. A. Jones and Shipman, Limited (stand nos. 4221, and 7609), machine-tool producers.

Farnborough

Further to the notice in the JOURNAL of July 27, announcing the SBAC Exhibition at Farnborough (September 4 to 10), the following firms have advised their participation in this event: Sterling Metals, Limited, on whose stand (no. 5) will be shown a number of sand- gravity-die, and precision moulded castings in light alloys; English Steel Corporation, Limited (stand no. 127); Alcan Industries, Limited (stand no. 189); Desoutter Brothers, Limited (stand no. 248).

Heating, Ventilating and Air Conditioning

The Heating, Ventilating and Air Conditioning Exhibition, Empire Hall, is to be held at Olympia, London, September 26 to October 6. Firms participating include Keith Blackman, Limited (stand no. 18) who will be exhibiting fans, dust and fume control, and filter equipment; the Electrical Development Association will demonstrate the latest techniques in electric heating and air conditioning; and Dallow Lambert & Company, Limited, will show full-scale equipment for wet and dry dust control, under operating conditions on stand 121.

A REQUEST BY BRITISH RAILWAYS to postpone a petition by Montrose Foundry, Limited, has been rejected by the local Dean of Guild Court. The firm asked for a warrant to extend their premises at Bridge Street, Montrose, at an estimated cost of £1,600. The alterations will permit the firm to produce non-ferrous, in addition to ferrous castings.

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AP67

Current Prices of Iron, Steel, and Non-ferrous Metals

(Basis prices, delivered unless otherwise stated. Prices following side headings marked* are subject to an increase of 1 per cent. under Iron and Steel Board Price Determination, 1961, No. 2.)

August 23, 1961

PIG-IRON

* **Foundry Iron.**—No. 3 IRON, CLASS 2, 10-ton lots or over, Middlesbrough, £21 17s. 0d.; Birmingham, £21 9s. 3d.

* **Low-phosphorus Iron.**—Over 0.10 to 0.40 per cent. P, 10-ton lots or over, £23 5s. 0d., delivered Birmingham; £23 10s. 0d., delivered Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 6s. 6d.; South Zone, £25 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.; North Zone, £26 6s. 6d.; South Zone, £26 9s. 0d.

* **Hematite.**—Si less than 2 per cent, S. & P. over 0.03 to 0.05 per cent., 10-ton lots or over: N.-E. of England (local iron), £23 19s. 0d.; Scotland (Scotch iron), Zone S.1, £24 5s. 6d.; Sheffield, £25 9s. 0d.; Birmingham, £25 13s. 0d.; South Wales (Welsh iron), £23 19s. 0d.

* **Basic Pig-iron.**—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire in 10-ton lots or over.

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Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

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Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

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* **Small Bars, Sheets, etc.**—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 6d.; under 4 tons to 2 tons, £41 3s. 6d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3 mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £67 4s. 0d.

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Zinc.—Second half August, £75 0s. 0d. to £75 2s. 6d.; second half November, £76 2s. 6d. to £76 5s. 0d.; settlement, £75 2s. 6d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £113 7s. 6d.; rolled zinc (boiler plates), all English destinations, £111 0s. 0d.; zinc oxide (Red Seal); d/d buyers' premises, £92 10s. 0d.

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Brass (High Tensile).—BS1400, HTB1, £193; HTB2, £214; HTB3, £229.

Gunmetal.—BS1400, LG2, £219; LG3, £229; G1, 1% £299; G1, 1%, £289.

Phosphor Bronze.—BS1400, PB1 (AID released), £316; BS1400, 90/10/1, £304.

Leaded Phosphor Bronze.—BS1400, LPB1, £243.

Phosphor Bronze Strip, etc.—Strip, 297s. 3d. per cwt.; wire, 4s. 2d. per lb.; rods, 3s. 4½d.; tubes, 3s. 4½d.; chill cast bars, solids 3s. 5d.; cored, 3s. 6d. (CHARLES CLIFFORD LIMITED).

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Translation Services

From amongst the most recently published lists of translations available from the Iron & Steel Institute (4, Grosvenor Gardens, London, S.W.1), the following have been selected as being of interest to founders. The price quoted is that for single copies, postage extra, there being reductions for quantities ordered. Readers writing for translations, or for further information, should mention this JOURNAL when doing so.

BISI 2020 MANUFACTURE OF PARTLY-CHILLED ROLLS FROM SPHEROIDAL-GRAPHITE CAST IRON. Rusiew, R. D. *Prz. Odlew.*, 1960, *10*, (4), 106-111. (£4 5s.) (From Polish.) Work done in Bulgaria is described. By adding 0.54 per cent. Mg and changing flake to spheroidal-graphite a considerably tougher material was obtained suitable for roughing rolls in the hardness range 200-280 H_B. The author describes the technology of casting, chemical composition, structure and properties of these rolls. Experience has shown that by introducing spheroidal-graphite rolls throughput was increased from 20-25 by 10^3t to 35-40 by 10^3t. In conclusion the author indicates further progress in the production of spheroidal-graphite iron where the carbon content is low and the Si content is increased to 2.0-2.1 per cent. with small additions of Ni and Cr. (*JISI* abstract.)

BISI 2166 DETERMINATION OF NITROGEN IN STEEL, IRON AND FERRO-ALLOYS. (From French.) Calmettes, J., and H. Guinot. *Rev. Mét.*, 1960, *57*, Oct., 925-933. (£3 15s.)

BISI 2167 ANALYSIS OF HYDROGEN, OXIGEN AND NITROGEN IN METALS UNDER REDUCING CONDITIONS IN ARGON. (From French.) Hancart, J., and J. Marot. *Rev. Mét.*, 1960, *57*, Oct., 911-917. (£4 5s.)

BISI 2337 JALOUSIE-TYPE DUST CATCHERS FOR GAS CLEANING. (From Russian.) Kanfer, V. D., and M. S. Shklyar. *Metallurg*, 1961, *6*, Mar. (£1 10s.)

Translations in Preparation

New translations in course of preparation include:—

BISI 2336 DEGASSING OF LIGHT-METAL ALLOYS BY SOUND VIBRATIONS. (From German). Esmarch, W., *et al.* Wissenschaftliche Veröffentlichungen aus den Siemens Werken Werkstoff-Sonderheft, 1940, 78-87.

BISI 2347 RESIDUAL ELEMENTS IN STEELS. (From Spanish). Palacios Reparaz, J. M. *Instituto del Hierro y del Acero*, 1961, 14, (74) special number April, 397-419.

BISI 2356 SURFACE DEFECTS IN PRECISION CASTING. Nickel, E-G. Paper given at the European Conference on precision casting, 1958, May, Paris, 5 pages.

BISI 2362 EXPERIENCES IN TREATING THE SURFACE OF SEMI-FINISHED PRODUCTS OF ALLOY STEELS BY FLAME GOUGING AND GRINDING. (From German). Geipel, H. *Stahl Eisen*, 1961, *81*, June 8, 787-794.

BISI 2368 GAS REMOVAL FROM ARC FURNACES WITHOUT LIDS. (From German.) Sem, M. *Radex Rund.*, 1961, (3), 607-614.

Brutcher Translations

The following translations are in course of preparation by Mr. H. Brutcher, Technical Translations, P.O. Box 157, Altadena, California, USA:—

HB 5215 INVESTIGATIONS ON THE TRANSFORMATION BEHAVIOUR, NOTCH TOUGHNESS AND TENDENCY TO INTERGRANULAR CORROSION OF CHROMIUM STEELS CONTAINING UP TO 30 PER CENT Cr. Baerlecken, E., *et al. Stahl Eisen*, 1961, *81*, June 8, 768-778.

HB 5218 ABATEMENT OF DUST NUISANCE FROM ARC FURNACES. Hohenberger, A. *Ibid.*, 1961, *81*, (15), 1001-05.

HB 5219 ON THE SECONDARY COOLING IN CONTINUOUS CASTING (OF STEEL). Aketa, Y., and K. Ushihima. *Tetsu to Hagane*, 1960, *46*, (7), 753-57.

Other People's Translations

The initials BCIRA, etc., stand for the organization to which enquiries for the following translations should be made, quoting the reference numbers. The addresses are given at the end of the list.

BCIRA 1002 NEW AUTOMATIC MOULDING EQUIPMENT. Bergmann, H. *Giesserei*, 1960, *47*, Sept. 8, 487-92.

BCIRA 1004 MECHANISM OF EUTECTIC CRYSTALLIZATION OF WHITE CAST IRON. Bunin, K., and S. Rapoport. *Metallurg*, 1938, No. 11, (107), 29-34.

MT 192 LOSS THROUGH COMBUSTION OF ALUMINIUM DURING THE DEOXIDATION OF STEEL IN AN ARC FURNACE. Fremont, P., and K. Stránsky. *Slévarenství*, 1961, *9*, (4), 126-131.

BCIRA 1003 SPECIAL CUPOLA-MELTING OPERATIONS. PART 2. THE DUPLEX PROCESS, CUPOLA-ELECTRIC FURNACE. Friedel, W. *Giessereitechnik*, 1960, *6*, Aug., 241-43.

MT 191 STATE OF DEVELOPMENT OF ECONOMICAL AUSTENITIC STEELS OF THE Cr/Mn/Ni/N TYPE. Hybek, K., J. Solc, and M. Zezulová. *Strojírenství*, 1961, *11*, (4), 275-82.

BCIRA 1006 DUST-CONTROL PROBLEMS IN THE FOUNDRY INDUSTRY. Klinge, U. *Giesserei*, 1960, *47*, Sept. 22, 526-30.

DSIR M 2365 INDEX OF ARTICLES PUBLISHED IN 1959 IN LITEINOE PROIZVODSTVO. (Russian Castings Production). *Lit. Proizv.*, 1959, (12), 46.

DSIR M 2364 FIRST RUSSIAN MANUAL FOR FOUNDRY PRACTICE AND ITS AUTHOR: MINING ENGINEER APOLLON FEDOROVICH MEVIUS. Modolevich, D. M. *Lit. Proizv.*, 1959, (12), 43-45.

BCIRA 1011 PRODUCTION OF CAST-IRON HOLLOW-WARE. "UNUSUAL FOUNDRY PRODUCTS" Paschke, F. IN GIESSEREI-PRAXIS. 1956, March 25, 105-107.

BCIRA 1010 RELATIONSHIP BETWEEN WET STRENGTH AND TENDENCY TO DEFECTS OF GREEN SAND. Patterson, W., and D. Boenisch. *Giesserei*, 1961, *48*, Apr. 6, 157-66.

BCIRA 1001 ADVANTAGES OF MELTING WITH CALCIUM CARBIDE ADDITIONS IN THE COLD-BLAST CUPOLA. Stephan, G. *Giessereitechnik*, 1959, *5*, June, 176-77.

BCIRA 1005 CAST IRON FOR THE MANUFACTURE OF ALKALI-RESISTING BOILERS. Vashchenko, K. I., A. N. Firstov, P. V. Avrinskii, V. L. Neveselovskii, and V. V. Zhishchenko. *Lit. Proizv.*, 1960, (1), Jan., 7-10.

Symbols for Sources of Translations

BCIRA: British Cast Iron Research Association, Bordesley Hall, Alvechurch, Birmingham. MT: M. de O. Tollemache, The Old Rectory, Lewknor, Oxon, and DSIR: Department of Scientific and Industrial Research, 20, Chester Terrace, London, N.W.1.

New translations, now in preparation, which will be included in the BISI Translation Service if more requests are received:—

E 2365 CONTROL DEVICE FOR ELECTRIC CURRENT IN STEEL-MELTING ARC-FURNACES. (From Russian). Svenchanskii, A. D. *Vestnik Elektroprom.*, 1960, Aug., 23-26.

E 2370 A SPECTROGRAPH FOR ANALYSING MOLTEN METAL AND SLAG. (From Russian). Kustanovich, I. M. Ibid., 451-462. (*Abstracts J. Met.*, 1959, (11/12), Abs. 413; *Referativnyi Zhurnal Metallurgiya*, 1959, (11), Abs. 25187).

Ionizing Radiations Regulations

The Ionising Radiations (Sealed Sources) Regulations, 1961,* made by the Minister of Labour, Mr. John Hare, were presented to Parliament on August 3. Most of the requirements will come into operation in six months time, but those requiring the notification of the use and disuse of ionising radiations in factories will be effective from August 15.

The Regulations impose requirements for safeguarding the health and safety of persons employed in factories and other places to which the Factories Acts apply, who may be exposed to ionising radiations from sealed radio-active substances, and from certain machines, such as X-ray apparatus. They require the restriction of the exposure of workers to such radiations, the adequate shielding of sources of ionising radiations and instructions for employers likely to be exposed to them about the hazards involved and the precautions to be taken. Maximum permissible doses of radiation are laid down, and the Regulations include requirements for the medical supervision of employers, and for the wearing of film badges to measure personal doses received.

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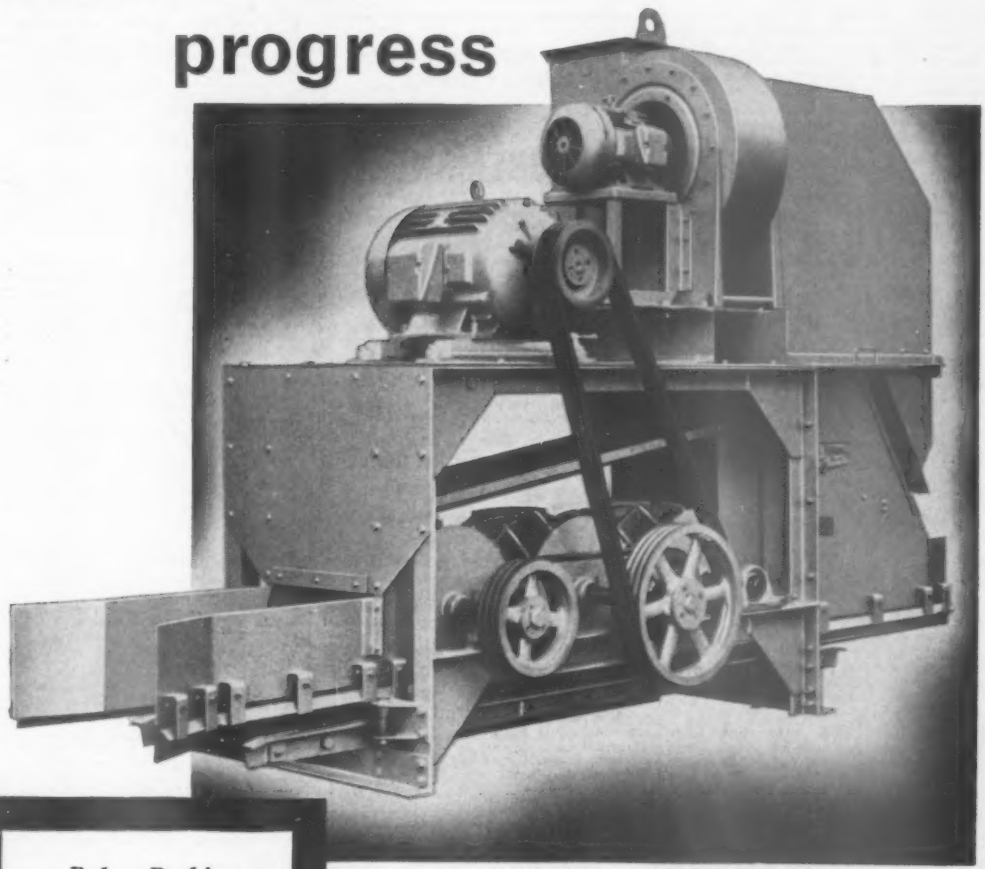

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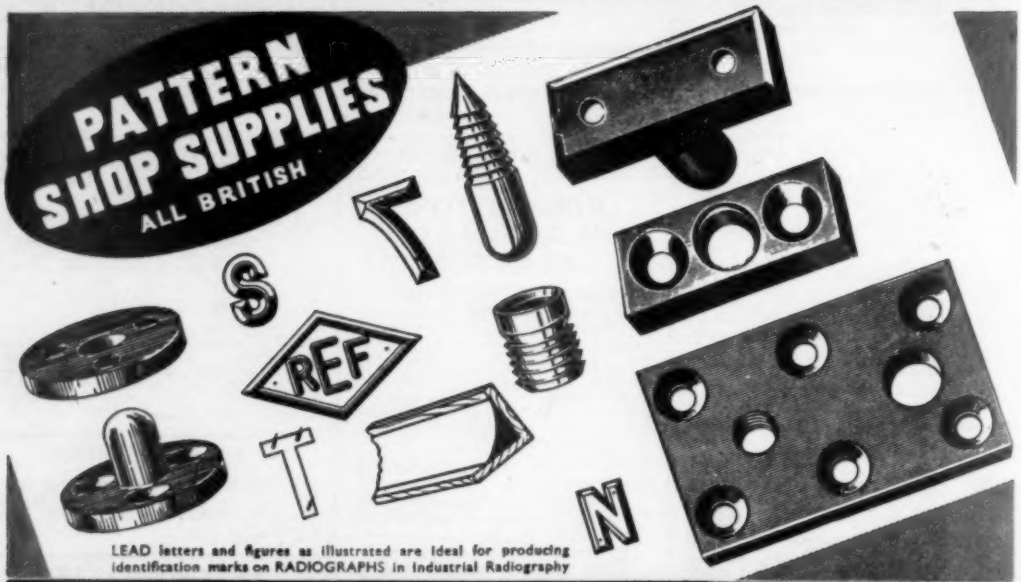

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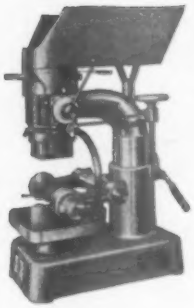

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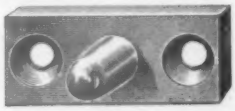

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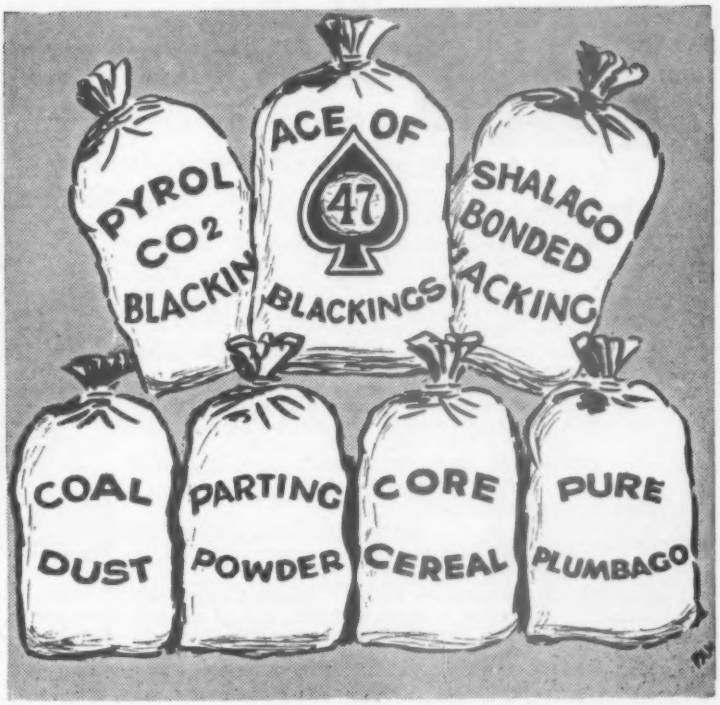

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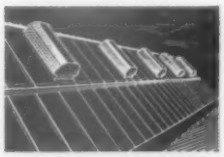

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INDEX TO ADVERTISERS

PAGE NOS.

A.E.I.-Biriec, Ltd. .. —
A.E.I. Plastics (Aldridge) Ltd. .. —
Acme Conveyors, Ltd. .. 11
Air Control Installations Ltd. —
Albion Diemakers Ltd. .. 44
Albion Pulverising Co. Ltd. —
Allan, John, & Co. (Glenpark), Ltd. .. —
Alley Compressors, Ltd. .. —
Amafond .. .. .. —
Amber Oils, Ltd. .. .. —
Anderson-Grice Co., Ltd. .. —
Annealers, Ltd. .. .. —
Armstrong Whitworth (M.I.), Ltd. .. —
Ashworth Ross & Co., Ltd. —
Aske, Wm., & Co., Ltd. .. —
Associated Lead Mfts. Ltd. 20
Atlas Copco (G.B.), Ltd. .. —
August's, Ltd. 32
Austin, E., & Sons, Ltd. .. —

Badische Maschinenfabrik A.-G. .. .. —
Bairds & Scottish Steel, Ltd. —
Baker Perkins, Ltd. .. 33
Balbardie, Ltd. .. .. —
Ballard, F. J., & Co., Ltd. —
Ballinger, L. J. H., Ltd. .. —
Bellias & Morcom, Ltd. .. —
Bennett, H. G., & Co. (Gloves), Ltd. .. —
Berk, F. W., & Co., Ltd. —
Bilston Stove & Steel Truck Co., Ltd. .. 39
Birkett, F. W., & Co., Ltd. —
Birlec-Efco (Melting), Ltd. —
Blackwell's Metallurgical Works, Ltd. .. —
Boydell, E., & Co., Ltd. .. —
Bradbury, John & Co. (Stockport), Ltd. .. —
Bradley & Foster, Ltd. .. 10
British Acheson Electrode, Ltd. .. .. —
British Aero Components, Ltd. .. .. —
British Cast Iron Research Association .. —
British Electrical Repairs, Ltd. .. .. —
British Foundry Units, Ltd. 17
British Industrial Sand Ltd. —
British Iron & Steel Federation .. .. —
British Monorail, Ltd. .. —
British Moulding Machine Co., Ltd. .. 1
British Resin Products Ltd. —
British Ronceray, Ltd. .. —
British Shotblast & Engineering Co., Ltd. .. .. —
Broom & Wade, Ltd. .. —
Buckland Sand & Silica Co., Ltd. .. .. —
Burn, John, & Co. (B'ham), Ltd. 38
Burnand, W. E., & Son, Ltd. —

Canning, W., & Co., Ltd. .. —
Carborundum Co., Ltd. .. —
Catalin, Ltd. .. .. —
Cawood Wharton & Co. Ltd. 44
Chapman & Smith, Ltd. .. —
Chemicals & Feeds, Ltd. .. —
Chetham Timber Co. Ltd. —
Ciba (A.R.L.), Ltd. .. .. —
City Casting & Metal Co. Ltd. 42
Clayton Crane & Hoist Co. Ltd. —
Cleanair, Ltd. .. .. —
Cohen, Geo. Sons & Co., Ltd. —
Coleman-Wallwork Co. Ltd. 23
Combustion Chemicals, Ltd. —
Consolidated Pneumatic Tool Co., Ltd. .. —
Constructional Engineering Co., Ltd., The .. 28
Controlled Heat & Air, Ltd. —
Conveyor & Shotblast, Ltd. —
Cooke, Bailey, Ltd. .. —
Coreshooters Sales, Ltd. .. —
Corrosion, Ltd. .. .. —
Cox & Danks, Ltd. .. —
Crockett Lowe, Ltd. .. —

PAGE NOS.

Crooks, L. E. .. .. —
Cumming, Wm., & Co., Ltd. 43

Dallow, Lambert & Co. Ltd. —
Dickson, Roy Wilson, Ltd. —
Distillers Co., Ltd., The .. 6
Dowler, H. J., Engineers & Pattern Makers, Ltd. .. —
Dowson & Mason, Ltd. .. —
Dunford & Elliott (Sheffield), Ltd. .. .. —
Durrans, James & Sons, Ltd. 12
Dustruction, Ltd. .. .. —
Dustuctor Co., Ltd. .. —
Dyson, J. & J., Ltd. .. —

Electrical Development Association .. .. —
Electrogenerators, Ltd. .. —
Elliott Bros. (London), Ltd. —
Elliott, E., Ltd. .. .. —
Engineering Services (Manchester) Ltd. .. —
Ertel Ores, Ltd. .. .. —
Escol Products, Ltd. .. —
Evans, James, & Co., Ltd. —
Evans, Roy, M.I.B.F. .. 39
Evans, Stanley N., Ltd. .. 13
Eyre Smelting Co., Ltd. .. —

F. & M. Supplies, Ltd. .. —
Feico Hoists, Ltd. .. .. —
Fenton Byrn & Co., Ltd. .. —
Fliter-Heat, Ltd. .. .. —
Fischer, George, Ltd. .. —
Fisher-Foundries, Ltd. .. —
Fletcher Miller, Ltd. .. —
Flextol Engineering Co., Ltd. 7
Fordath Engineering Co., Ltd. 47
Foseco International, Ltd. 25
Foseco, Ltd. .. .. —
Foundry Equipment, Ltd. .. 14 & 15
Foundry Mechanisations (Baillot), Ltd. .. 19
Foundry & Metallurgical Equipment Co., Ltd. .. —
Foundry Plant & Machinery, Ltd. .. .. —
Foundry Suppliers, Ltd. .. 39
Foxall, William, Ltd. .. —
Foxboro Yoxall, Ltd. .. —
Frankiss, R. J. (Patterns) Ltd. —
Franklin Furnace, Ltd. .. —
Fuel & Metallurgical Processes, Ltd. 24
Fullers' Earth Union, Ltd., The .. .. —
Furnascote, Ltd. .. .. —

G.W.B. Furnaces, Ltd. .. —
Gas Council .. .. —
General Electric Co., Ltd. .. 22
General Refractories, Ltd. 16
Gliksten, J., & Son, Ltd. .. —
Goodyear Tyre & Rubber Co., Ltd. 243
Graphite Products .. —
Great Lakes Carbon International, Ltd. .. .. —
Green, E., & Son, Ltd. .. —
Green, Geo., & Co. .. 43
Gregory, J. G., & Sons, Ltd. —
Griffiths, A. E. (Smethwick), Ltd. .. .. —
Guest, Keen Iron & Steel Works 18
Guyson Industrial Equipment Ltd. .. .. —

Harborough Construction Co., Ltd. .. .. —
Hargraves Bros. (Manchester), Ltd. .. 40
Harris & Pearson, Ltd. .. —
Harvey & Longstaffe, Ltd. —
Harvey, J. J. & Pressurecast, Ltd. .. .. —
Hedin, Ltd. 44
Heneage Metals, Ltd. .. —
Hepburn Conveyor Co., Ltd. —
Heywood, S. H., & Co., Ltd. —
High Speed Steel Alloys, Ltd. —
Hills (West Bromwich), Ltd. 45
Holman Bros., Ltd. .. —
Holmes, W. C., & Co., Ltd. —

PAGE NOS.

Holroyd & Hall, Ltd. .. —
Hooker, N. (Foundry Supplies), Ltd. 42
Hooker, W. J., Ltd. .. —
Ilford, Ltd. .. .. —
Imperial Chemical Industries, Ltd. .. .. —
Incandescent Heat Co., Ltd. .. 26 & 27
Ingersoll-Rand Co., Ltd. .. —
International Combustion, Ltd. 29
Interpias .. .. .. —

J.S. Pattern Products, Ltd. —
Jackman, J. W., & Co., Ltd. —
Jacks, Wm., & Co., Ltd. .. 247
Joy Sullivan, Ltd. .. 4

Keith Blackman, Ltd. .. —

L.M.S. Products, Ltd. .. —
Lafarge Aluminous Cement Co., Ltd. 245
Laidlaw, Drew & Co., Ltd. —
Leicester Lovell & Co., Ltd. —
Levy, B., & Co. (Patterns), Ltd. 38
Lones, Joseph, Laboratories —
Lord, E. S., Ltd. .. .. —
Luke & Spencer, Ltd. .. —

Macnab & Co., Ltd. .. 41
Major, Robinson & Co., Ltd. 44
Mansfield Standard Sand Co., Ltd. .. .. —
Marshall, Thomas (Loxley) Ltd. .. .. —
Mathison, John, Ltd. .. —
Matthews & Yates, Ltd. .. —
May, J. H., Ltd. .. .. —
Mead McLean & Co., Ltd. —
Mellor Mineral Mills, Ltd. .. 8
Metalectric Furnaces, Ltd. —
Metalline Cement Co., The —
Metals & Equipment (Wolverhampton), Ltd. .. —
Midgley & Son, Ltd. .. —
Midland Monolithic Furnace Lining Co., Ltd. .. 44
Midland Tar Distillers, Ltd. 45
Modern Furnaces & Stoves, Ltd. .. .. —
Molineux Foundry Equipment, Ltd. .. .. —
Monometer Manufacturing Co., Ltd. .. .. —
Morganite Crucible, Ltd. .. —
Morris, Herbert, Ltd. .. 9

Newton Collins, Ltd. .. —
Nicholl & Wood, Ltd. .. —
Norris Equipment & Construction, Ltd. .. —
North Derbyshire Metal Products, Ltd. .. —
Norton Grinding Wheel Company, Ltd. .. —
Norton Industries, Ltd. .. —

Ormerod, R. E., Ltd. .. —
Orthos, Ltd. .. .. —

Palmer Aero Products, Ltd. —
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Parker Mitchell Engineering Co., Ltd. .. .. —
Parmelee (G.B.), Ltd. .. —
Passe, I. & I., Ltd. .. —
Paterson Hughes Engineering Co., Ltd. .. .. —
Patterncrafts, Ltd. .. —
Pearson, E. J. & J., Ltd. .. —
Peco Machinery Sales, Ltd. —
Perry, G., & Sons, Ltd. .. 37
Phillips, J. W. & C. J., Ltd. 41
Pickard, W., & Co., Ltd. .. 42
Pickford, Holland, Ltd. .. 20
Platt Metals, Ltd. 247
Pneulec, Ltd. .. .. —
Polygram Castings Co., Ltd. —
Precision Presswork Co. Ltd. —
Price, J. T., & Co., Ltd. .. 48
Production Chemicals (Rochdale), Ltd. 40
Purimachos, Ltd. .. .. —

Reavell & Co., Ltd. .. —

PAGE NOS.

Refined Iron Co. (Darwen), Ltd. .. .. .. —
Reid, Wm., & Co. .. .. —
Resinous Chemicals, Ltd. .. —
Richards Structural Steel Co., Ltd. .. .. —
Richardson Eng'g., Ltd. .. —
Richardsons Moss Litter Co., Ltd. .. .. —
Richardsons, R. J. & Sons Ltd. 48
Ridsdale & Co., Ltd. .. 48
Robinson, Thos., & Son Ltd. —
Robson Refractories, Ltd. —
Roper, E. A., & Co., Ltd. .. 5
Rowland, F. E., & Co., Ltd. —
Rubery Owen & Co., Ltd. .. —
Rule & Moffat .. .. —
Rustless Iron Co., Ltd. .. —

Safety Products, Ltd. .. —
Salter, Geo., & Co., Ltd. .. —
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Smiths Motor Accessories, Ltd. .. .. —
Soles, J. M. .. .. —
Spencer & Halstead, Ltd. .. —
Spermolin, Ltd. 3
Stansby, W., & Co., Ltd. .. 38
Stanton & Staveley Sales, Ltd. .. .. —
Steels Engineering Installations .. —
Stein, John G., & Co., Ltd. —
Stephens, Wm., & Sons, Ltd. —
Sterling Foundry Specialties, Ltd. 30
Sternol, Ltd. .. .. —
Suffolk Iron Foundry (1920), Ltd. .. .. —
Sutcliffe Speakman, Ltd. .. —

Tallis, E., & Sons, Ltd. .. —
Taylor, J. (Syston), Ltd. .. —
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Thomas, Gwyn, & Co. .. —
Thompson, John, Instrument Co., Ltd. .. .. —
Thomson & McIntyre .. —
Thor Tools, Ltd. .. .. —
Tilghman's, Ltd. 21

Union Carbide, Ltd. .. 2
Unit Engineering Co. .. —
United Fireclay Products, Ltd. .. .. —
United States Metallic Packing Co., Ltd. .. .. —

Verrolec, Ltd. .. .. —
Victor Products, Ltd. .. —

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Walsh Bros. .. .. —
Ward, Thos. W., Ltd. .. —
Warner & Co., Ltd. .. —
Warrington Red Moulding Sand Co. .. .. —
Watsons (Metallurgists) Ltd. 40
West Midland Refining Co., Ltd. .. .. —
Whitecross Co., Ltd. .. —
Wild-Barfield Electric Furnaces, Ltd. .. .. —
Wilkinson Rubber-Linatex Co., Ltd. .. .. —
Wilson Crucible Co., Ltd. .. —
Witham, L. A., & Co. .. 40
Woking Pattern Works, Ltd. —
Woodward Bros. & Copelin, Ltd. .. .. .. —

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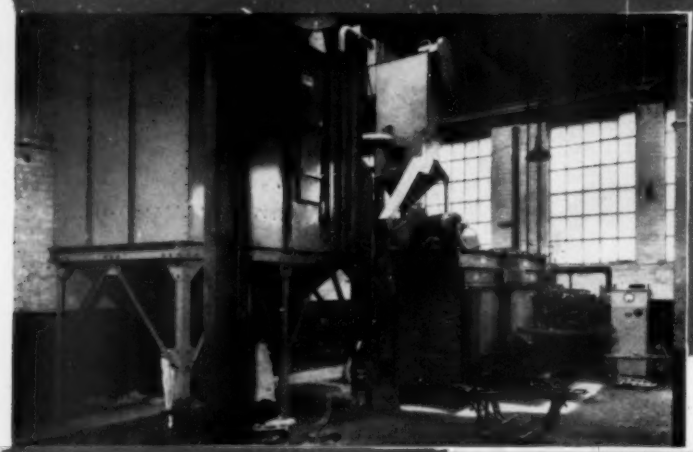

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